AUTOMOTIVE and Aviation INDUSTRIES

JULY 1, 1946

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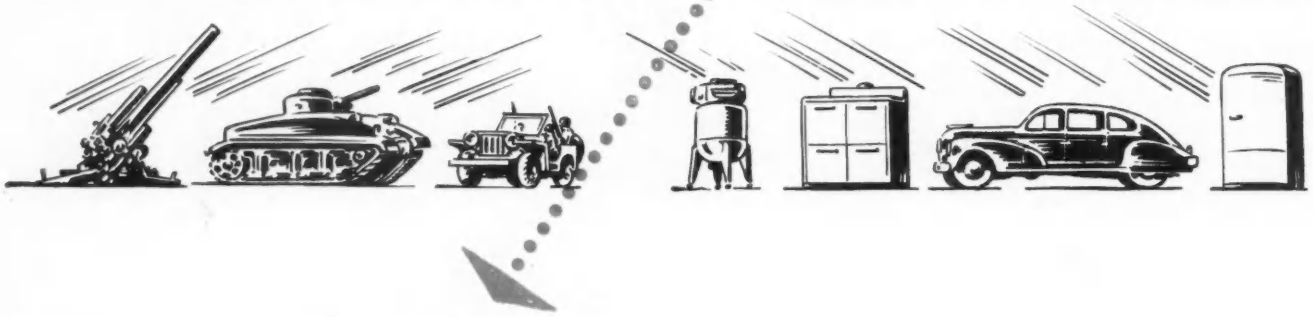

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AUTOMOTIVE and Aviation INDUSTRIES

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CONTENTS

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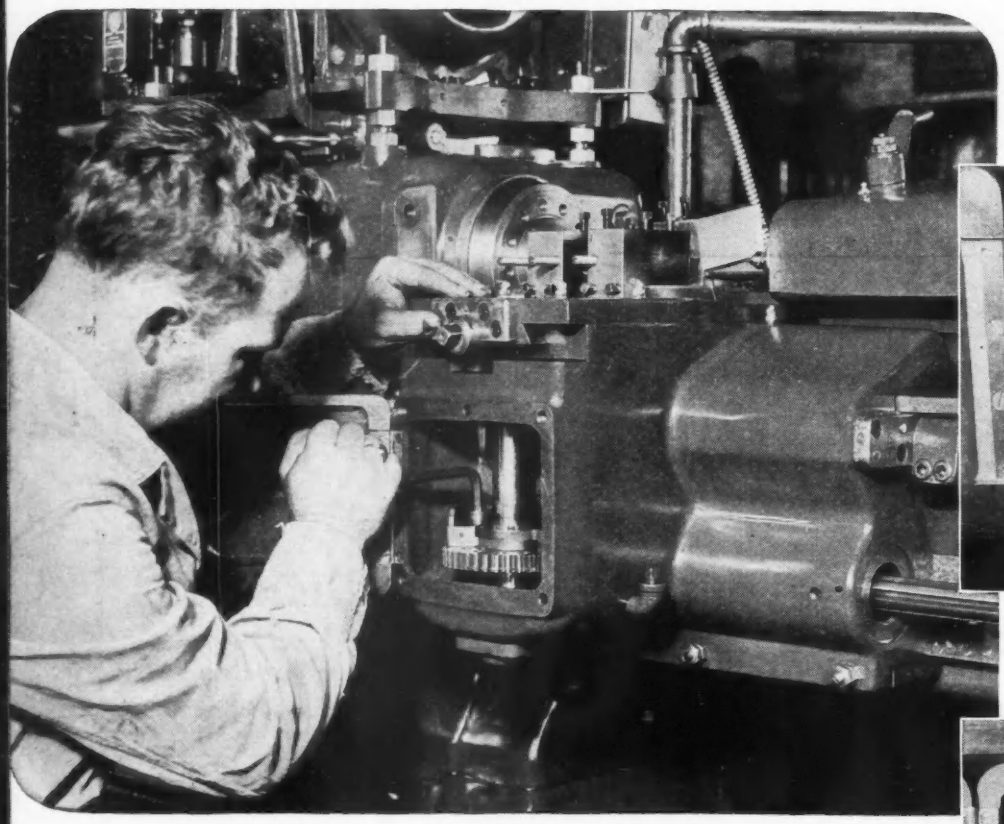
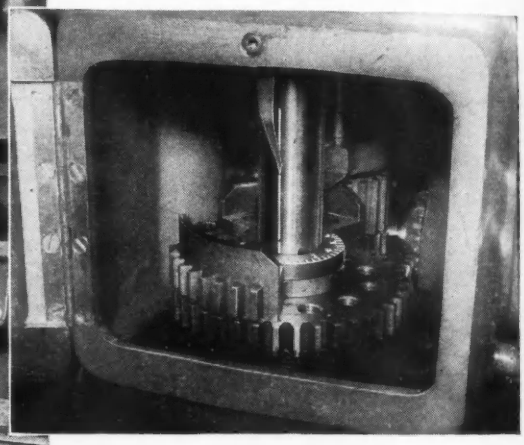
MACHINE OF THE MONTH

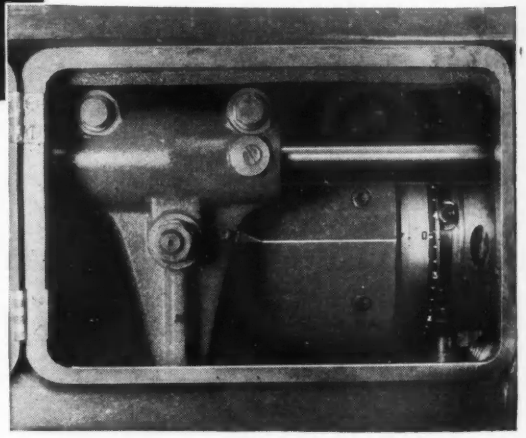
PREPARED BY THE SENECA FALLS MACHINE CO. **"THE *Lo-swing* PEOPLE"** SENECA FALLS, NEW YORK



Close-up view of Simplified Change-Over Mechanism.



Close-up view of drum cam showing index line and graduated adjustment ring.



ALL *Lo-swing* AUTOMATIC LATHES PROVIDE FOR SIMPLE CHANGE-OVER FROM JOB TO JOB

Production men appreciate the speed and simplicity with which all automatic Lo-swing Lathes can be changed-over from job to job. A hinged door on the Model "LR" provides easy access to the Simplified Change-Over Mechanism located on carriage front. Simply loosen two cap screws and move gear segment to graduation on scale corresponding to desired length of cut in inches. Tighten cap screws, and carriage is timed for the job at hand. Cam is standard and does not have to be changed, and since the cycle is closed and locked, machine cannot get out of time.

Rapid traverse adjustment is accomplished with equal ease and speed thru the hinged door at the head end of machine. Loosen two cap screws and slide the ring which is graduated in inches around until the length of cut desired in inches is opposite the zero mark. This automatically positions the rapid traverse control cams so that the remainder of the cycle is completed in rapid traverse. A Rapid Traverse Control Handle, conveniently located just below the door opening, further facilitates this adjustment and reduces change-over time.

All Lo-swing Automatic Lathes now have this Simplified Change-Over Mechanism as an inbuilt feature.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the first and 15th of the month

July 1, 1946
Volume 95, No. 1

Wagnerian Unwisdom

By Julian Chase

SENATORS and Congressmen and Presidents, too, can be wrong. They are made of the same varied and variable stuff as the rest of us. They are subject to prejudices and faulty convictions. They err in other ways. Theoretically, and only theoretically, they are selected for their jobs because of their supposed fitness to fulfill their obligations in proposing, framing and approving sound legislation. Conclusive evidence of persistent fallibility should rule them out as it rules out executives in business. It should, but does it? Politicians thrive, quite obviously, on promiscuous promising and lavish catering to privileged pressure groups.

The present situation in the field of labor relations prompts us, among other things, to recall the glittering promises that were made by the sponsors of our major labor law, the Wagner Act, when it was debated before passage in Congress. It is a measure, said Senator Wagner, "designed to promote industrial peace." Such poor designing would cost any engineer in industry his job. The bill, he also said, has nothing in it that "promotes union monopoly, places the stamp of government favor on any type of union, or outlaws the so-called company unions." When questioned about the rights of workers who do not want to strike, Representative Connery, the father of the bill in the House, replied, "You are discussing an act to *prevent* strikes." At another time he said, "No employer can be forced to make a closed-shop agreement."

Figures on the number of strikes before and after the Wagner Act cannot be too often repeated. From 1928 to 1932 inclusive the number of strikes in all industry averaged 762 per year with a yearly average of 773,900 man-days of idleness and loss of wages. In 1933 there were 1695 strikes; in 1934, 1856; in 1935, the year the Wagner Act became effective, there were 2014. After the adoption of "an act to *prevent* strikes," we had 4740 strikes in 1937, 4288 in 1941, 4956 in 1944 and in 1945 we had 4600. Since 1937 to the end of 1945 the average yearly loss in production and wages, measured in terms of man-days, has been 15,400,000. In the month of February, 1946, alone it was 21,500,000. Is this the industrial peace that Senator Wagner promised us?

The record of abuses of employee by employer, however extensive it may have been in the days which are now hard to recall specifically, has been wiped clean or at least completely covered and made utterly obscure by the abuses inflicted on industry, on the national economy and on the public welfare by organized labor. At no other time did so few men exercise so much selfish power as is now concentrated in and actively exercised by a figurative handful of labor fuehrers. "Organized labor," said Senator Reed, "has been endowed with special privileges and immunities and powers of aggressive action which permit and actually encourage national unions to over-ride the police powers of local and state governments, and even to over-awe the Federal government with demonstrations of private

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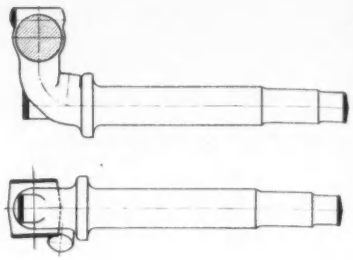
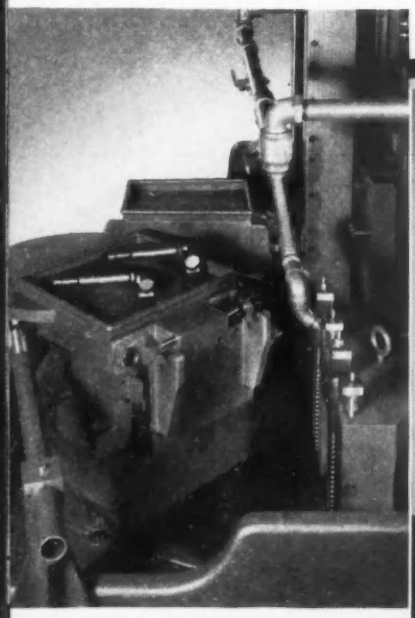
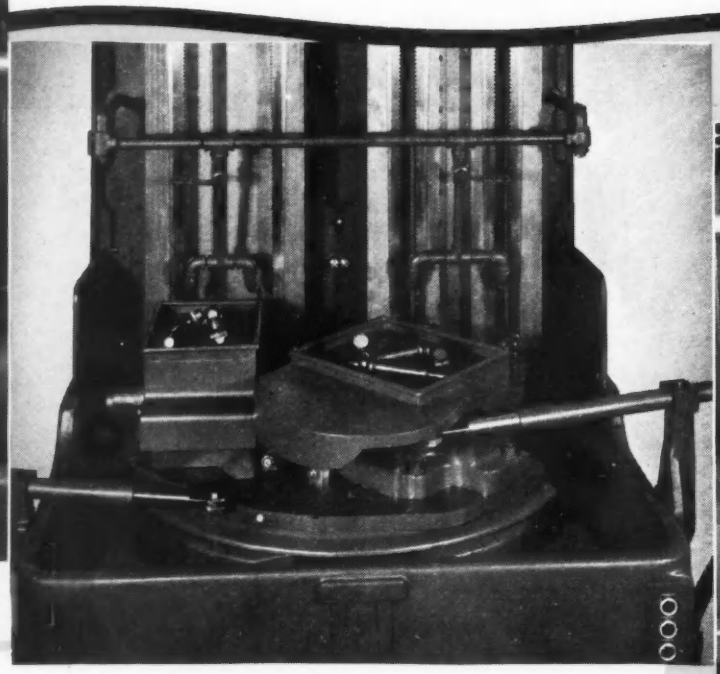
RIGHT- AND LEFT-HAND PARTS BROACHED

without changing setup

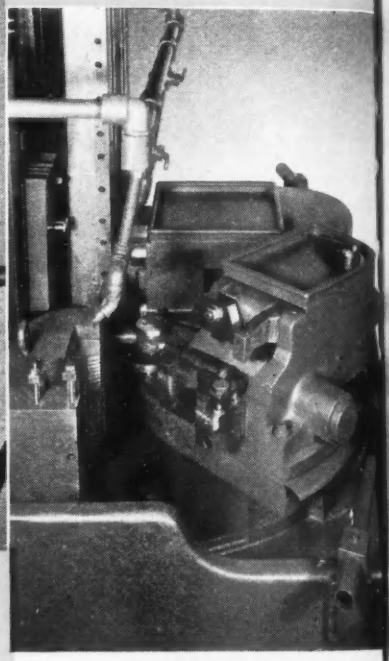




...and fixture, with two stations (one for each ...for straddle broaching 1-5/16" diameter bosses

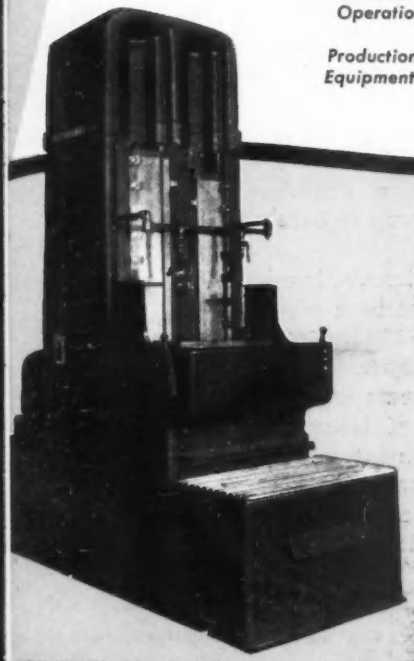


Front view of machine, showing fixtures, automatic clamping, and cutter inserts



Left-hand fixture holds either part for broa... to length and broaching pin boss

Part name: Steering knuckle pin—right- and left-hand.
Material: Steel forging.
Operation: Broach to length, broach pin boss and straddle broach large bosses.
Production: 170 per hour.
Equipment: CINCINNATI No. 10-50 Vertical Hydro-Broach completely equipped by Cincinnati Application Engineers.



...NCINNATI No. ...66 Duplex Ver- ...l Hydro-Broach ...chine. Write for ...alog M-1387-1

CINCINNATI

Machining operations on right- and left-hand parts assigned to the same machine often require different fixtures, or at least interchangeable fixture elements . . . and it takes time to change the setup from one part to the other. Cincinnati Application Engineers eliminated this hindrance to the production of steering knuckle pins by designing fixtures and broach holder assemblies, illustrated above, to handle both right- and left-hand parts on a CINCINNATI No. 10-54 Duplex Vertical Hydro-Broach. ¶ The right-hand fixture has two stations; either right- or left-hand parts can be broached. When one station is being used, the other station automatically becomes inoperative. The left-hand fixture, a single station unit, accommodates both right- and left-hand parts. ¶ Cincinnati Application Engineers, well versed in mass production techniques and pioneers in applying the broaching method to moderate quantities, will be glad to analyze your machining problems, and recommend the right machine and tooling. Send blueprint with complete details.

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Makers Strive for

Equitable Distribution of New Cars

By Leonard Westrate

WITH car-hungry buyers swamping salesrooms ready to lay cash on the line for new automobiles, and with production far behind originally projected schedules, it is small wonder that hints of favoritism and downright chicanery in juggling delivery dates have arisen from impatient and disappointed customers. Human nature being what it is, there probably is at least a grain of truth in some of the charges. In fact, sales managers of automobile companies will admit under questioning that a very small percentage of dealers are taking advantage of the famine and are not hewing to the line of equitable distribution. However, all the evidence available indicates that most reputable dealers are playing fair with their public and that the principle trouble is lack of production to meet the unprecedented demand.

There have been some charges that manufacturers have been playing favorites, supplying certain dealers with more than their share of cars at the expense of others. It can be said unequivocally that such a charge is untrue. A check with all the companies shows that rigid and carefully calculated allocation systems are in effect and are being adhered to with utmost inflexibility. It is true that some dealers may get considerably more cars than others but only because their particular quota is higher owing to previous performance or some other factor. In any event, whatever maladjustment or juggling of deliveries occur, they are the direct result of negotiations between the dealer and the buyer, and in no way can be charged to the manufacturer.

The methods used by the various companies to insure fair distribution to dealers of the limited number of cars available comprise two broad general bases. The most generally used criterion of what share of total production should be allotted to the dealer is his historical base of performance, usually 1941 sales. A second-method is to make a sales analysis of the volume potential for a particular dealership, and base the allotment on that. Sometimes a combination of the two methods is used. When the historical base is considered, the dealer's sales percentage of base period total sales for all dealers is his factor. Thus, if his total sales in the base period amounted to 300 cars and his company's dealer sales total was 500,000 cars during the period, his percentage factor would be .0006. Since most manufacturers retain a reserve, usually 15 per cent, the percentage factor is applied to total production minus the reserve. In addition, some companies have a bonus plan running up to 60 per cent over the base allotment. The bonus is figured in various ways. In General Motors, for example, the bonus for some dealers comes from the allotment which would have gone to dealers who dropped out during the war; other classifications, such as new dealers, get their bonus from the company reserve.

Nash has adopted the market potential basis for calculating quotas after a three-year survey in 285 key points. Dealers are given a contract for the number of cars the particular location will support in a normal competitive market. In addition, a bonus is provided up to 60 per cent above the contract in order to take care of the present sellers' market. The bonus comes out of production minus reserve. Nash dealers are in a good position, because the number of retail outlets has been reduced from nearly 2000 to about 1400 during the war, and the emphasis is on fewer,

(*Turn to page* 62, *please*)

Novel Design

DEVELOPMENT of a new air-cooled, slide valve engine line at Jack & Heintz Precision Industries, Inc., has reached the point where they are producing a limited number of two, four, and six-cylinder models. Table I gives the basic specifications thus far released by the company. Fig. 1 gives the performance curves for the six-cylinder model. Fig. 2 shows the aircraft and automotive engine versions of the six-cylinder model.

The production models of the engine are designed to be largely fabricated of die cast aluminum or magnesium alloys. They are a horizontally-opposed type which incorporates slide valves. The six cylinder model engine consists mainly of 12 individual aluminum or magnesium die castings: two main cases, cylinder heads, oil pan, accessory cover, front and rear covers. The main cases, Fig. 3, are identical and consist of one bank of cylinders and half a crankcase. These are bolted together on the center line of the crankshaft. Oil pans will be available for either wet sump or dry sump, and the accessory covers will be available for all versions with different mounting pads for the accessories which are required.

The complete crankshaft assembly, Fig. 4, consists of the crankshaft, main bearings, connecting rods, pistons, and piston pins and embodies numerous unusual features. The crankshaft is of the built-up type in which several individual pieces are joined together by a splined-pin arrangement. All of these component parts are made from alloy steel forgings and in the case of the six-cylinder shaft, several identical pieces are required for each assembly. This construction eliminates the necessity of

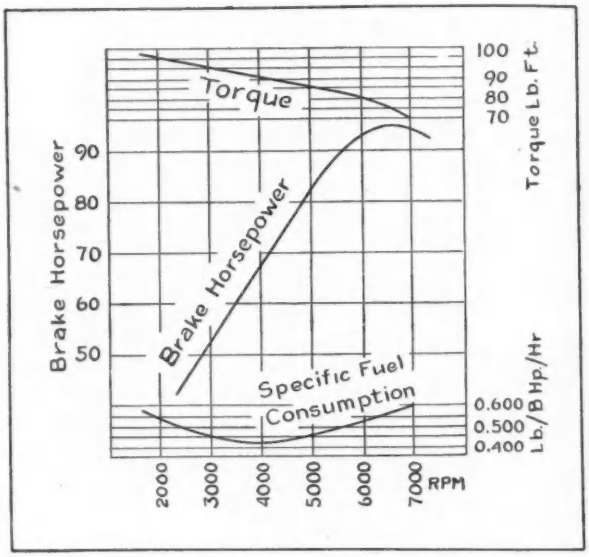
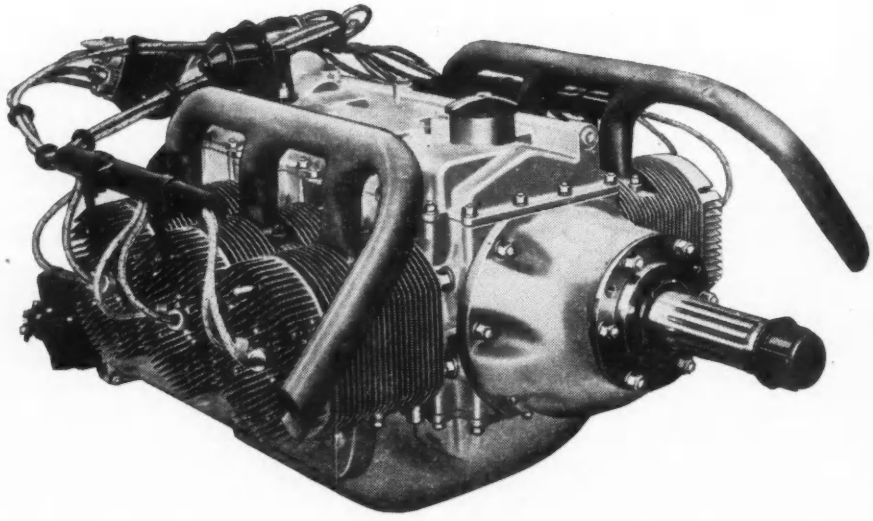


Fig. 1—Performance curves of the 126 cu in. six-cylinder, slide valve engine from tests conducted at Jack & Heintz Laboratory.



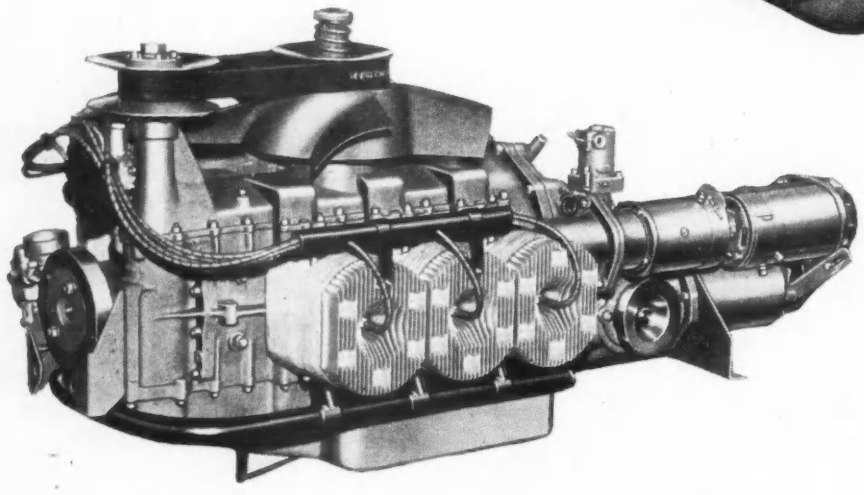


Fig. 2—Top Aircraft version of the new J & H six-cylinder power plant. (Left) Automotive version complete with clutch, transmission, differential, governor, cooling system and standard accessories.

Features of

Jack & Heintz Engines

using split connecting rod or main bearings. A newly-developed bearing alloy is bonded directly to the crankpins, main journals and thrust surfaces of the crankshaft. The connecting rods are alloy steel forgings with a standard bushing pressed into the piston pin end. The main bearing blocks are light alloy die castings into which are fitted nitralloy bushings superfinished on the inside diameter to provide a smooth circular bearing surface. The piston is an aluminum forging. The piston pin is the free floating type superfinished and fitted with an aluminum retainer pressed into each end.

The valve shaft assembly, Fig. 5, consists of the valve shaft, timing gear, three pairs of supports, valves, and eccentrics together with their levers, connecting rods, and pins. The valve shaft is driven through a plastic laminated fabric gear at one-quarter engine speed by a steel pinion on the crankshaft. The supports are magnesium die castings and provide bearing surfaces for the valve shaft as well as the pins which locate the fixed end of the levers. Cast iron eccentrics which consist of a pair of eccentrics and an integral counterweight, are locked to the valve shaft. Their rotary motion is translated into the reciprocating motion of the slide valves by an aluminum forged connecting rod which rides on the eccentric and is attached to the forged steel lever. The levers are finished with a close fitting ball end which engages the socket

Table I—Basic Specifications of J & H Engines

Common to all models

Bore, in.	3.125
Stroke, in.	2.750
Rated speed, rpm	4500
Maximum speed, rpm	6000
Valve drive ratio	4 to 1
Compression ratio	8.5 to 1
Oil pressure, psi	50

	2-Cyl.	4-Cyl.	6-Cyl.
Displacement, cu in.	42.18	84.38	126.54
Rated power, bhp	20	45	75
Maximum power, bhp	30	65	95
Approximate bare engine weight, lb.	85	150	200
Overall length,* in.	12.5	19.5	25.25
Overall width,* in.	23.38	23.38	23.38
Overall height,* in.	22	23.8	23.8

* Includes cooling fan and all accessories

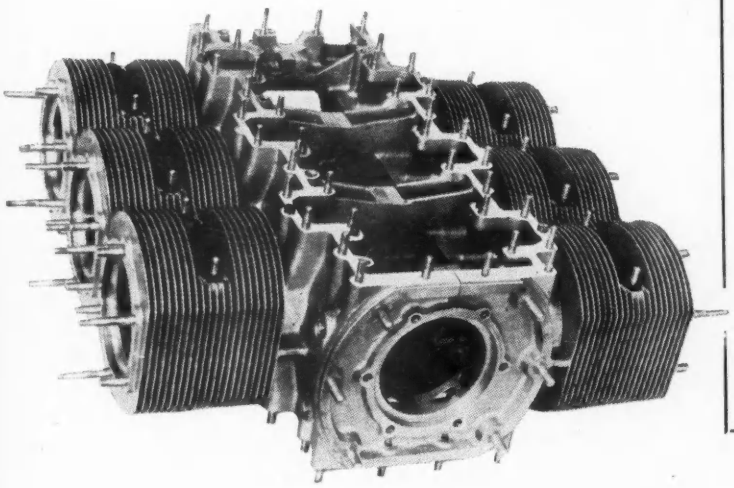


Fig. 3—Crankcase studding assembly of the 126 cu in. slide valve engine.

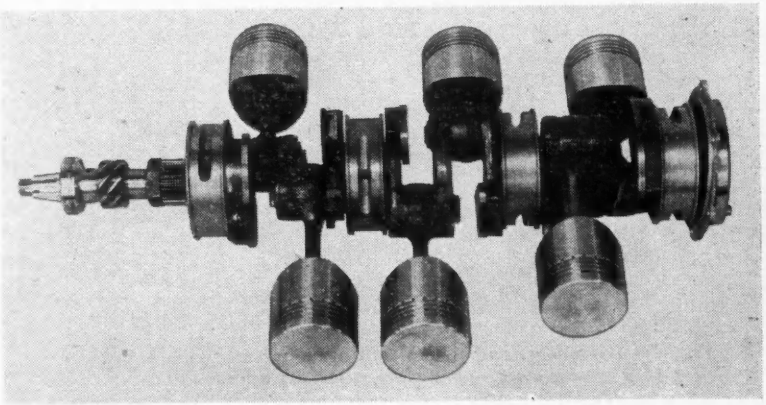


Fig. 4—Complete crankshaft assembly for the six-cylinder model.

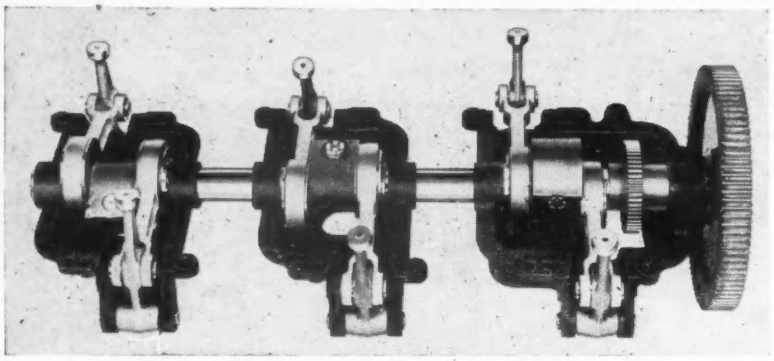


Fig. 5—Intake valve shaft assembly with oil pump driving gear.

riveted to the slide valves. The valves, Fig. 6, are made of nitrided alloy steel, accurately honed and superfinished to provide the good bearing surfaces. The port location in the valve is such that it travels above and below the port in the combustion chamber during each suceeding cycle. The valve opens and closes the port each time it traverses the port in each direction. Two valve assemblies are employed, one of which drives the intake valves and oil pump, while the other drives the exhaust valves and the accessories.

Each cylinder assembly, Fig. 7, consists of a pressure spring, reed type seals, sealing ring, port ring, cylinder and locating steel segments in addition to the crankcase and cylinder head castings mentioned previously. Each cylinder section of the crankcase has a circumferential groove cut at the lower end, and two steel segmets are placed in this groove. The alloy iron cylinder has a circumferential shoulder which bears against these segments and the port ring in turn rests on top of the cylinder. The lapped surface of the sealing ring mates with the top surface of the port ring, while the other end bears against the pressure spring. When the cylinder hold down nuts are tightened, the sealing spring is deflected by the cylinder head imposing a predetermined static load on the complete assembly which actually floats between the two slide valves.

Three features provide the seal that is required during the power stroke in an engine of this design. First, the port ring is split and its original tension permits it to perform like a piston ring for oil control by bearing against both slide valves. During the combustion stroke, the gas pressure forces it against the valves, sealing off any leakage that might occur at the ports. Second, the sealing ring is designed to utilize the gas pressures developed during the combustion stroke to increase the force acting on the surfaces of the cylinder port ring, and sealing ring thus eliminating any leakage at these surfaces. Third, the interference fit between the four thin steel reeds imbedded in the cylinder head and the inside diameter of the sealing ring prevent any gas leakage around the head. These reeds are installed in such a manner that the efficiency of the seal increases with the increase in gas pressure.

In keeping with the modern design trends, the present engine cooling system was developed for rear engine installations although its geometric location is of no consequence if sufficient openings are available for the entry and exit of the cooling air. The final design which is shown here incorporates a fan of die cast aluminum which is belt driven through a pair of variable speed sheaves. The sheave at the fan is spring loaded, and changes in the fan speed ratio are accomplished by a hydraulic servo actuated by engine oil pressure. A manifold pressure and temperature sensing device provides the control for the hydraulic servo.

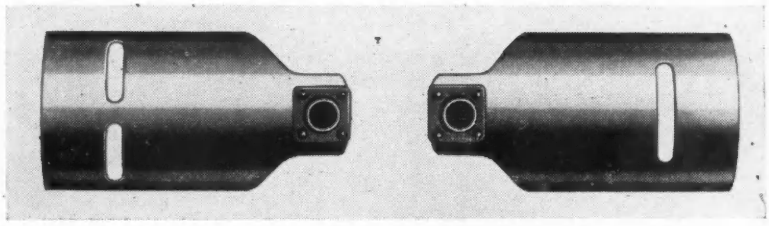


Fig. 6—Intake valve with dual port (left) and exhaust valve with single port (right).

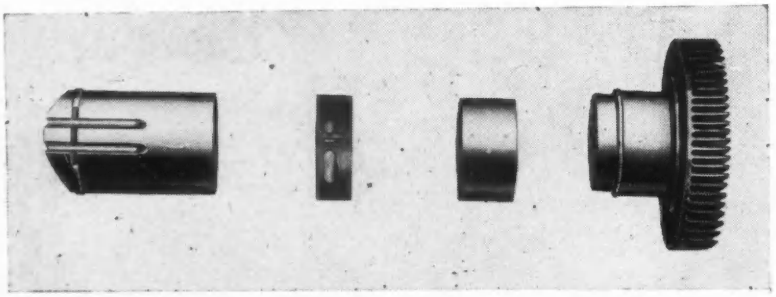


Fig. 7—Cylinder head with sealing spring and reeds, sealing ring, port ring, and cylinder.

Three different ignition systems are available on the various engine models. A magneto system is available which utilizes the engine flywheel as the induction rotor. The conventional battery system, consisting of battery, coil, cam and breaker as well as the conventional magneto and distributor system are also available.

Pressure lubrication is provided for all bearing surfaces. In the dry sump system, oil is drawn from the sump by the scavenge pump and is forced through a full-flow filter, then through an oil

(*Turn to page* 47, *please*)

A New Approach to

Statistical Quality Control

*by Joseph Manuele**
Director of Quality Control
Westinghouse Electric Corp.

TO COVER all operations in a plant with control charts is not economically justifiable; neither is personnel available for doing this work on such a tremendous scale. However, statistical methods are definitely valuable, especially in those cases where losses, due to rejections of parts, are high. The question is, "what is a good quality control program possessing possibilities for wide application, and how can such a program be started in the average plant?"

The first step is to acquire some information on: (1) which parts, or items, are of a satisfactory quality level, (2) which items are of such a low quality level as to result in rejections, and (3) what is the relative amount of rejections of each product? An economical inspection program for accumulating this information is the use of a simple sampling plan for sampling all lots of items processed.

The sampling plan should be designed so that ordinary shop inspectors can use it. It is well to recognize, however, that any sampling plan involves certain risks, and such risks should be defined in the plan. The plan should be flexible enough to separate lots according to the various levels of quality desired. It might be necessary to control one line of product at a quality level where defects will not be more than .5 per cent. In the case of other items, as high as five per cent defects might be allowed. Regardless of the level of quality which has been chosen, the plan must discriminate between good lots and bad lots.

Such a sampling plan is illustrated in Tables A and B and the accompanying Instruction Sheet, for a level

(*Turn to page 77, please*)

* Abstract of paper presented before A.S.T.E.

Sampling Tables Instructions

TABLES *A* and *B* have been calculated to pass lots which have not more than one per cent defective "in the long run." They also show the degree of risk of accepting individual lots containing more than one per cent defective.

Sampling Plan B is a supplement to Sampling Plan A. If 10 consecutive lots of an item pass Plan A, change to Plan B. If an item which is on Plan B fails to pass, even for a single lot, go back to Plan A until 10 consecutive lots of an item again pass.

Column two gives the number of samples which must be carefully inspected for any given lot size. The next column shows the allowable number of defective items in the sample; if more than the given number, the lot is to be detailed or rejected. The average quality of material accepted with this plan is better than one per cent defective. The risk of accepting an individual lot as much as five per cent defective is given in column four.

Sampling Table A

One Per Cent Defective Allowable

1. Lot Size	2. Sample Size	3. Number Defective Allowed in Sample	4. Risk of Accepting a Lot 5% Defective
200– 300	115	1	.13
301– 500	170	2	.11
501– 1000	220	3	.10
1001– 2000	230	3	.09
2001– 3000	240	3	.08
3001– 4000	290	4	.05
4001– 5000	300	4	.05
5001– 7000	345	5	.05
7001– 10000	395	6	.04
10001– 20000	460	7	.03
20001– 50000	540	8	.02
50001–100000	640	9	.01

Sampling Table B

One Per Cent Defective Allowable

1. Lot Size	2. Sample Size	3. Number Defective Allowed in Sample	4. Risk of Accepting a Lot 5% Defective
200– 300	70	1	.13
301– 500	80	1	.09
501– 1000	87	1	.07
1001– 2000	95	1	.05
2001– 3000	125	2	.05
3001– 4000	132	2	.04
4001– 5000	140	2	.03
5001– 7000	148	2	.02
7001– 10000	180	3	.02
10001– 20000	190	3	.01
20001– 50000	200	3	.01
50001–100000	210	3	.007

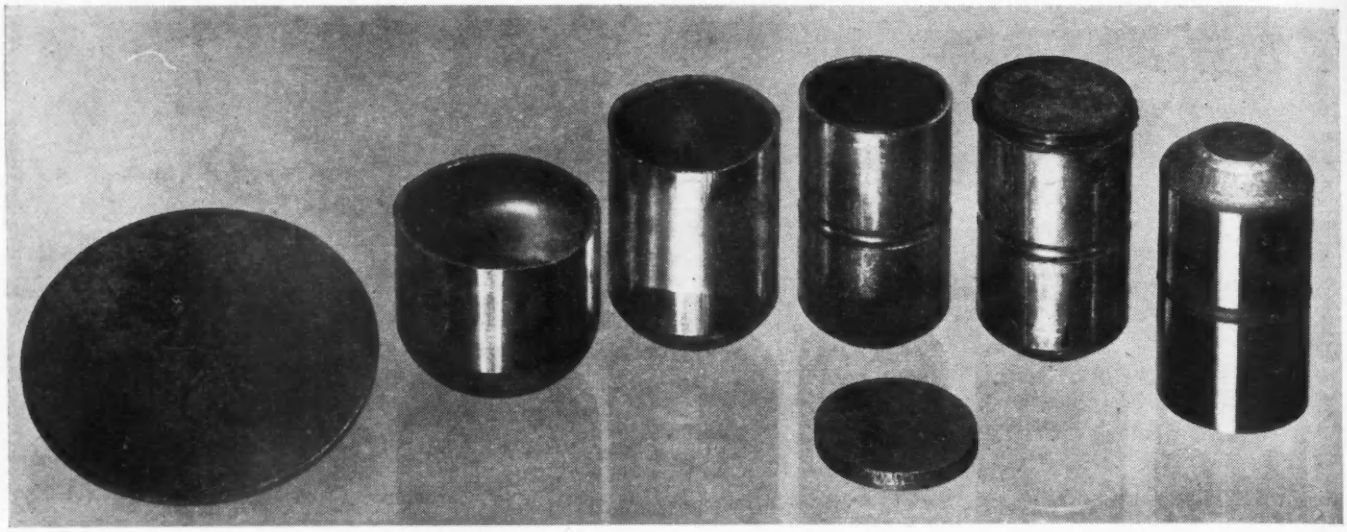


Exhibit showing progressive stages in the manufacture of the Ford valve push rod. The sheet metal blank is at the extreme left, the steel blank for the foot is in the foreground.

Profiting *from*

AN INTERESTING development stemming from war production experience is the valve push rod or tappet made as a fabricated assembly by the Ford Motor Company of Canada, Ltd. It offers a unique case study of a mass production process replacing conventional methods with resulting improvement in cost and serviceability.

As shown in Fig. 1 the assembly consists of a body extruded from a circular steel blank to which is welded the foot or base plate. In appearance, the finished piece looks exactly like one turned from solid stock. Apart from the press operations and welding, the major machining is done in Cincinnati centerless grinders, Cincinnati centerless lapping machines, and Blanchard surface grinders. Special attention is given to dimensional tolerances and surface finish specifications, the latter being established by the Profilometer.

Body diameter for the standard part is held to 0.9994-0.9996 in., while length is graded in increments of 0.001 in. Surface finish at the top contact and on the O.D. is held to 12 microinch (rms) maximum. At the foot, which is the contact with the cam, surface finish is held to 3.5 to 4.5 microinch (rms) and may have a maximum convexity at the center of 0.0015 in.

Before finish-grinding, the work is nitrided in a Carbo-Nitriding furnace while held to a temperature of 1540-1580 F., then quenched in oil and drawn in a Leeds & Northrup Homo furnace. The resulting surface is filed hard all over and with a hardness of R_c 58 –62 on the end.

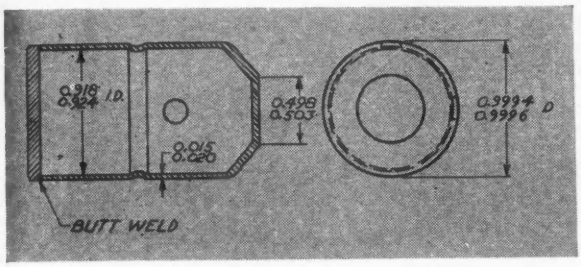
The department set up for making the push rod is self-contained and designed for economical straight-line production from start to finish. Owing to machine shortages during the war, it was necessary to improvise and to use such presses and grinders as were available.

The foot and body are produced on the equipment to be mentioned later and scheduled in proper quantities to feed the welder and final grinding operations. The

foot is blanked and embossed on a #675 Bliss press from Type 3A hot rolled strip. The discs are tumbled and washed, then ground on the O.D. to rough size in a #2 Cincinnati centerless grinder. They are washed, embossed in a P-5 press to produce an annular groove, washed again in preparation for welding.

The body is made from circular blanks, punched on a #675 Bliss press, using suitable salvage material of Class T, full cold-rolled, low carbon, open hearth steel. The blanks are inspected for surface and physical properties and copper plated in a Stevens plating machine. This plate serves a dual purpose. It acts as an extreme pressure lubricant in the deep drawing operations and masks the inner surfaces so as to prevent hardening in the nitriding furnace.

This is the 119th in the series of monthly production features



Drawing of the valve push rod assembly to show detail in cross-section.

The first draw is made in a #74 Bliss press, using a tungsten die. The second draw is in a DG53 Ferracute press; the third draw in a DG54 Ferracute press, using multiple stage indexing dies for the purpose. The stampings are washed, re-struck in a PG4 Ferracute press, and trimmed to length in a Bliss press. This is followed by the piercing of two 0.16 in. diameter holes in the body on a #6 Toledo press. Chief role of these holes is to prevent distortion or occasional

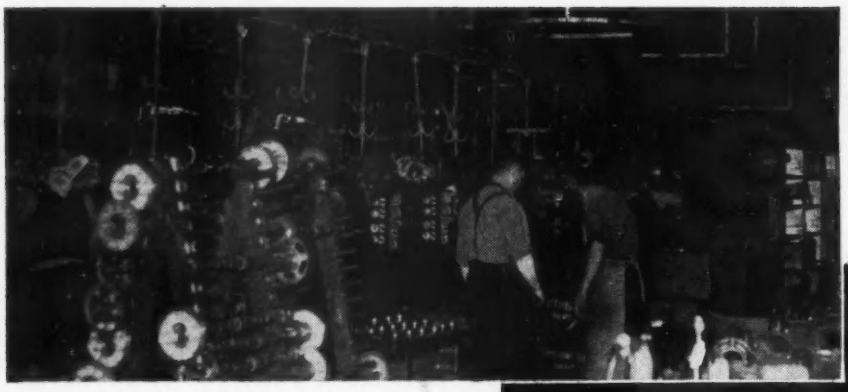
War Production Experience

at Ford of Canada

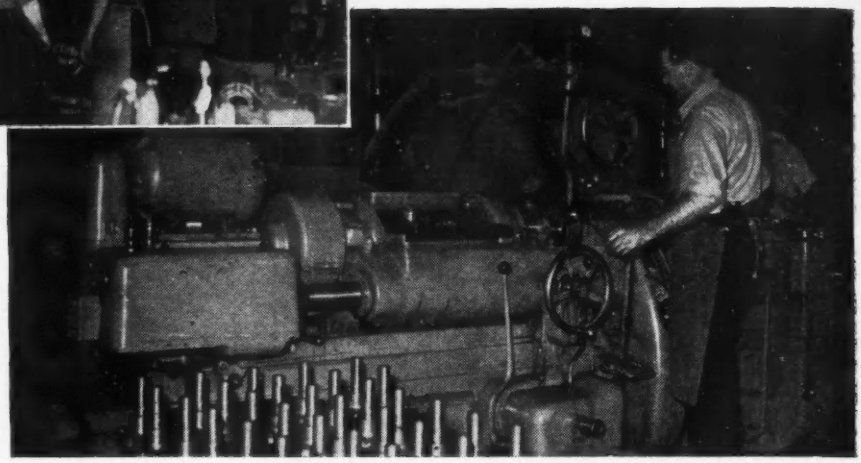
By Joseph Geschelin

(Left) This is one of the Blanchard surface grinding operations.

(Right) Here is the National electric butt welding machine used for welding the foot to the body. The 8-station fixture for work-holding may be seen in the center. The machine has a productivity of 6000 pieces in eight hours.



(Left)
A view in the engine machine shops showing one of the heavy duty monorail conveyor feeder lines carrying parts to the engine assembly line.



(Right)
Latest type Landis crankshaft grinder has been added to the crankshaft department. It is a rugged, hydraulic machine designed to finish all pins and journals in one setting.

swelling of parts during nitriding. Final operation is that of rolling the oil groove in the center of the body.

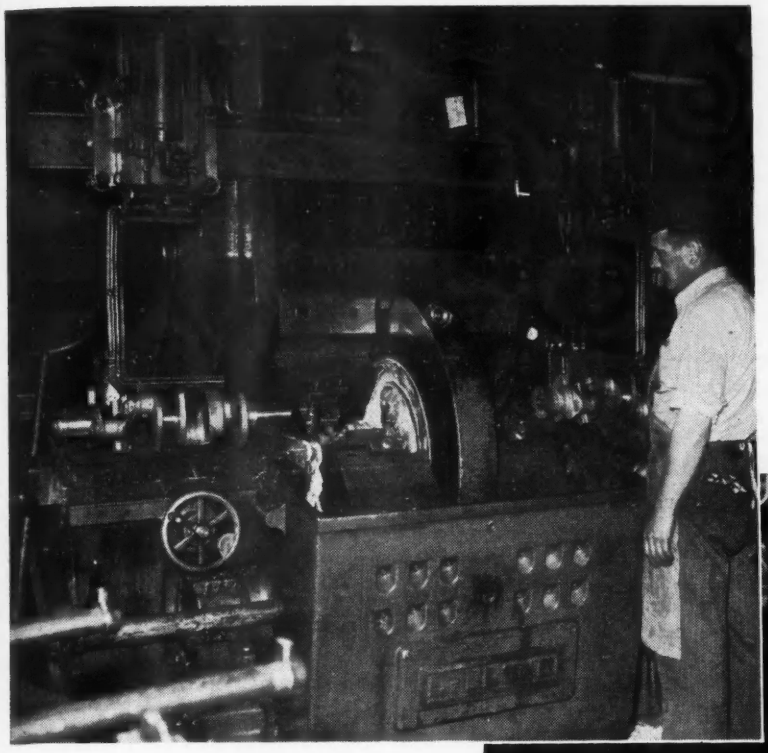
We are now ready for assembly and finishing operations. Butt welding of the foot disc and body stamping is done in a National Welding Machine unit which is fitted with a dial type indexing fixture holding eight pieces at a time. The work is held in place by automatically clamping an unclamping arms at the top of each fixture. As the work nears the unloading station it is automatically ejected by means of an air blast.

The sequence of operations from this point on is as follows:

Grind flash in one pass — **Cincinnati Centerless Grinder** with automatic feed.
Rough grind in two passes—**Cincinnati Centerless grinder** with **Danly automatic feed.**
Green grind foot—**Blanchard surface grinder.**
Light case carburize and quench—**Nitriding furnace.**
Wash, draw—**L & N Homo draw furnace.**
Semi-grind O.D. in two passes — **#2 Cincinnati Centerless grinder** with **Danly automatic feed.**
Wash, load in fixtures for the Blanchard grinders.

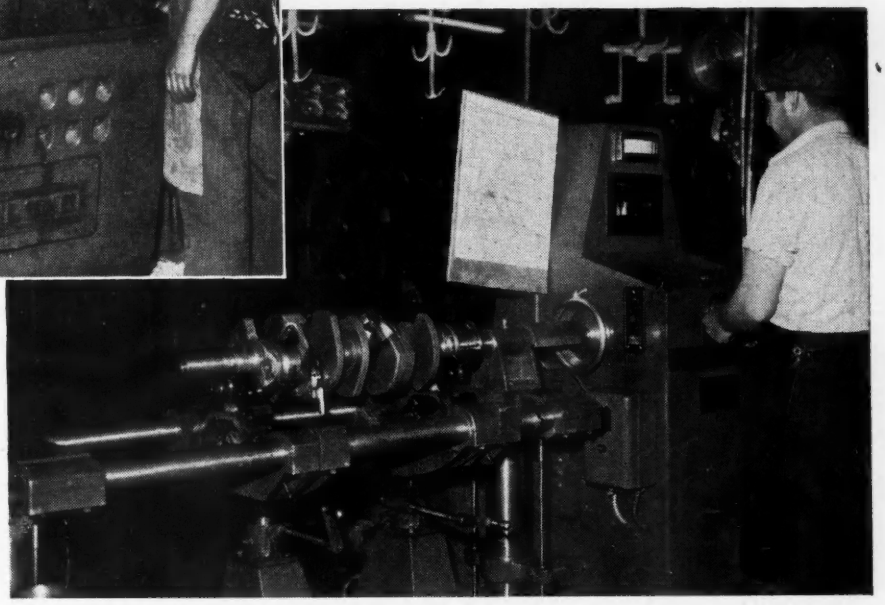
(Above) Finished push rods are checked for hardness on this bench, using Rockwell instruments.

(Right) Part of the row of Bliss presses set up in sequence for the extrusion of the push rod body. One of the indexing dial fixtures may be seen mounted on the press in the center.



(Left)
This is one of two LeBlond automatic crankshaft lathes of single-spindle, single-center drive type. They are tooled for simultaneously rough- and finish-turning the line bearings, flange end, and stub end.

(Right)
Close-up of the new Tinius-Olsen crankshaft balancing machine which supplements the older equipment in this department.



Grind both ends to length, one side at a time—**Blanchard Surface grinder.**

Fixtures then are unloaded and parts transferred from one fixture to another for chamfering the foot end—**Special Ford machine.**

Test for hardness—**Rockwell hardness tester.**

Lap O.D.—**Cincinnati Centerless lapper with Danly magazine feed.**

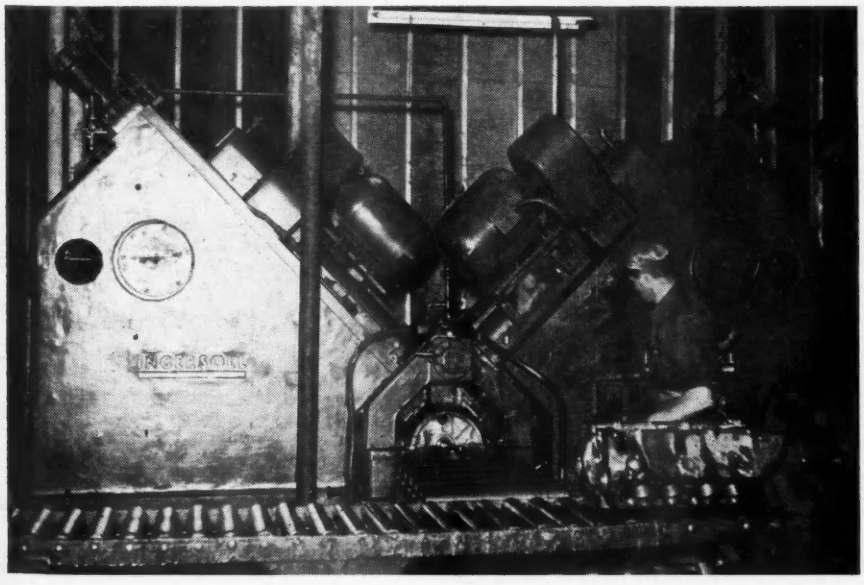
Wash, inspect, load on conveyor.

It will be noted from the foregoing that the part takes seven different grinding operations, including six passes through centerless grinders and a final centerless lapping operation. These are essential to the maintenance of dimensional tolerances and surface finish mentioned earlier. Moreover, final inspection requires both ends to be square with the O.D. within 0.0005 in. total indicator reading at outer edges. This condition is met by keeping good control and correlation of centerless grinding and surface grinding operations.

Although the cylinder block and crankshaft lines at the Ford Motor Company of Canada, Ltd., have been in operation for a number of years and are doubtless familiar to our readers, both lines have some items of new equipment which deserve special mention.

On the V-8 cylinder block

(*Turn to page* 64, *please*)



One of the two Ingersoll eight-spindle boring machines installed in the cylinder block line.

Performance Characteristics of

BMW-003 Turbojet *and Comparison with*

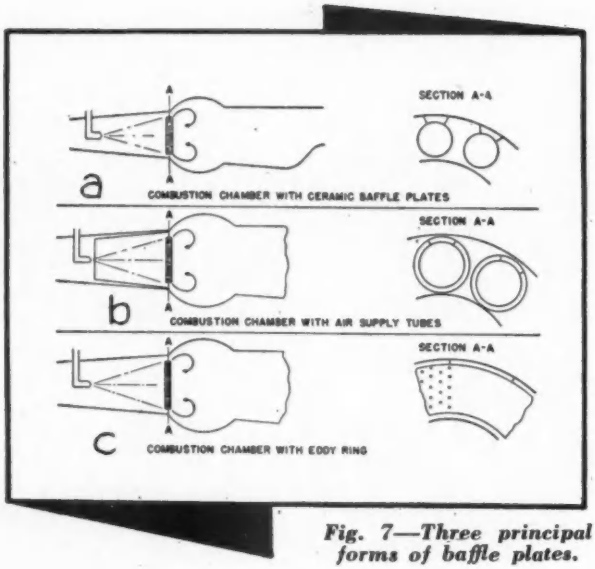


Fig. 7—Three principal forms of baffle plates.

THE German engineers interrogated admitted quite freely that they considered the 003A compressor performance rather poor and this is confirmed by the fact that there were two other compressor designs under investigation for this machine. These were the BBC Mannheim design for the 003C and the BMW advanced design for the 003D. Tests had demonstrated that for the 003A the major losses occurred in the stators, which were approximately 30 per cent reaction, and in an effort to improve the stator performance the latter designs employed about 50 per cent reaction. It is of interest to note that the Jumo 004 machine had almost pure impulse stators made of curved sheet metal and as a result required one more compressor stage to obtain the same pressure ratio. However, the thermal efficiency of the 004 compressor was slightly better than that of the 003.

Combustion Chamber

The combustion chamber of the 003 engine is interesting because it is of the annular chamber type. The Junkers 004 engine used individual burner cylinders, a form of combustion chamber which has gained many adherents both in England and in this country. The writers believe that the annular chamber type will ultimately prove to be best from an efficiency standpoint. The BMW engineers had apparently arrived at the same conclusion, and it is interesting to follow the successive steps in their burner development.

In their preliminary combustion chamber studies, the BMW engineers decided that the best way to provide stable combustion without blowout was to produce local eddy regions by installing baffles in the air stream. The three principal forms of these baffle plates are shown by Fig. 7.

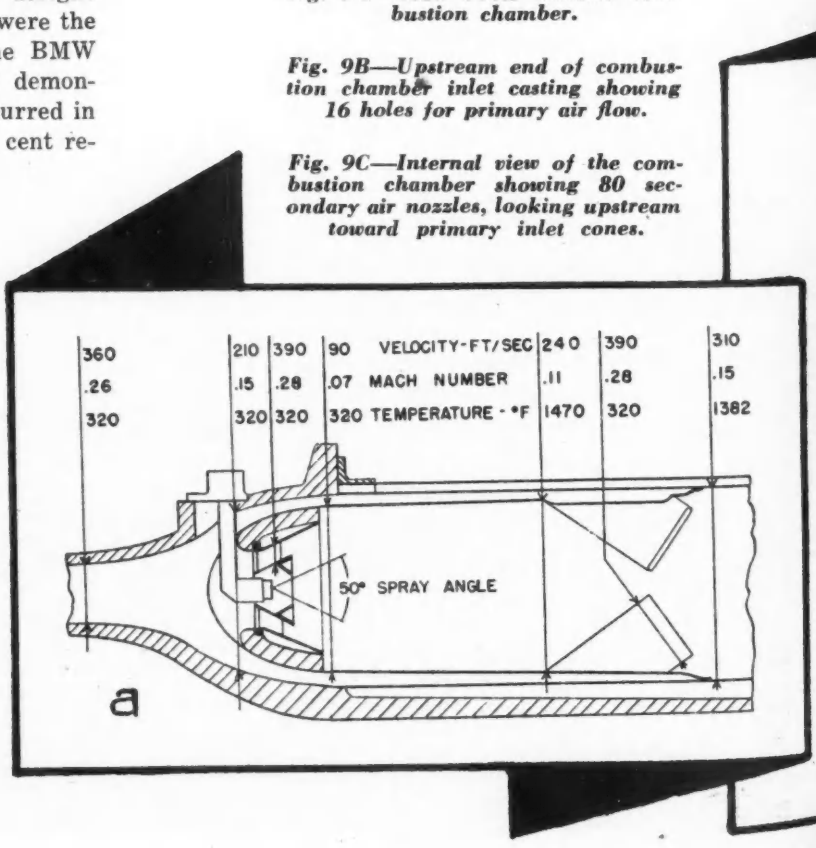
Fig. 7a shows the first form tried. This consisted of 16 individual ceramic baffle plates mounted in the annular chamber as shown. The fuel nozzles were located upstream and the fuel sprays were allowed to impinge on the baffle plates. The total airflow passed around these baffles. This arrangement proved to be generally unsatisfactory because the airflow around the baffles was nonuniform around the annular chamber and the resulting temperature distribution downstream of the plates was bad. The blowout characteristics were also unsatisfactory.

The second form of baffle plate burners is shown in Fig. 7b. In this case each baffle plate was supplied

Fig. 9A—BMW-003A annular combustion chamber.

Fig. 9B—Upstream end of combustion chamber inlet casting showing 16 holes for primary air flow.

Fig. 9C—Internal view of the combustion chamber showing 80 secondary air nozzles, looking upstream toward primary inlet cones.



Jumo 004

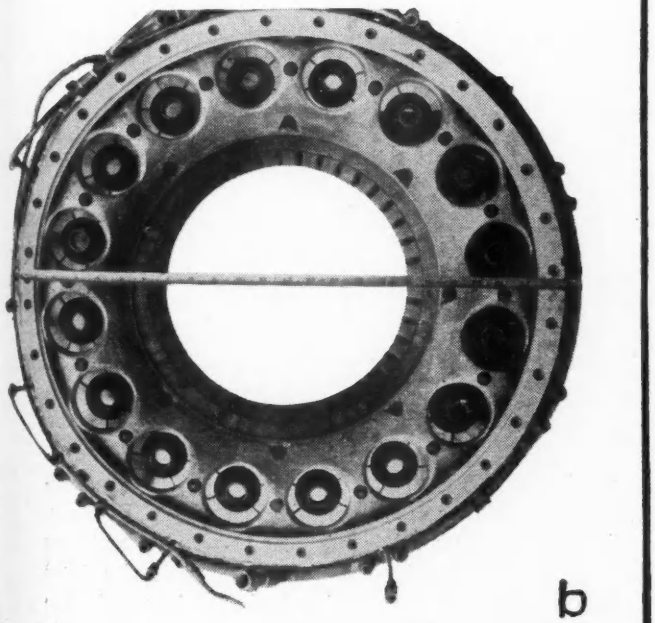
Part two

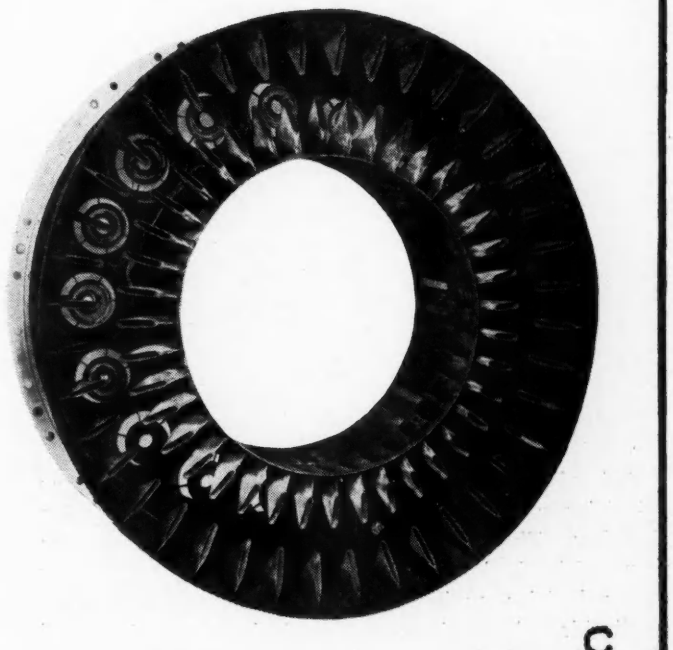
By W. G. Lindquist and R. W. Cole
Wright Aeronautical Corp.

with air through upstream projecting conical tubes. This resulted in considerable improvement in blowout characteristics and made possible full load airflow operation. Combustion efficiency and temperature distribution were still unsatisfactory. Both of the above forms also gave trouble because of breakage of the ceramic baffles.

In an attempt to correct these troubles, the ceramic baffle plates were replaced by perforated steel plates, with the arrangement otherwise the same as shown in Fig. 7b. The perforated steel plates further improved the blowout characteristics, and almost completely

Fig. 8—BMW-003A conical eddy producing burner.





eliminated the baffle plate breakage, making possible almost unlimited baffle plate life. Combustion efficiency and temperature distribution, however, were still not satisfactory. To improve these latter characteristics, additional round baffle plates were installed further downstream but no improvement resulted. The final baffle plate arrangement tried is shown by Fig. 7c. This consisted of a completely annular perforated steel baffle. The theory behind this attempt was that such an arrangement would produce a complete annular ring of flame. The results were disappointing. The continuous flame ring did not materialize, and the pressure drop was raised considerably.

At this stage of the development, the BMW engineers decided that there was something basically wrong with the baffle plate type burners. Although blowout characteristics were passable, combustion efficiencies were only in the order of 60 to 70 per cent. The maximum to mean temperature ratios were approximately 2.0 to 1. The flames were too long. These poor characteristics appeared to be caused by having the fuel impinge on the baffle plates and hence the remedy lay in injecting the fuel into the eddy regions downstream of the baffles. This was tried experimentally by installing the fuel nozzles downstream and spraying the fuel upstream into these eddy regions. The results apparently confirmed the theory. Combustion efficiencies were reportedly 20 per cent better and the maximum to mean temperature ratio dropped to 1.5 to 1. This arrangement was considered the best of the baffle plate type.

The baffle plate type burners did not go into production, however, in spite of the improvement noted above. While the experiments just described were going on, another means of producing the combustion chamber eddy zones was also being studied. This consisted of the conical eddy-producing burner shown by Fig. 8. With this type of burner, the fuel is sprayed directly into the toroidal eddy produced by the air flowing over the downstream edge of the burner cone. At the same time that BMW engineers adopted this type of burner, they also made another basic change in their attack on the burner problem by changing from a total to a partial airflow past these burner elements. To accomplish this, they separated the total airflow into primary and secondary streams, and passed only the primary air through the burner cones. The secondary air was diverted and introduced downstream. The relative proportions of primary and secondary air were experimentally determined and a final distribution of 60 to 70 per cent primary and 30 to 40 per cent secondary air was selected as optimum. All this finally led to the production combustion chamber which is shown by Fig. 9.

Referring to Fig. 9, it is interesting to note the gas velocities and Mach numbers through the combustion chamber. The advantage of the annular chamber can be noted in the low Mach numbers prevailing. The low gas velocities make the momentum pressure loss negligible. A small amount of air is admitted around the fuel nozzle itself. This reduces the temperature peak at the center of the flame core and also cools the nozzle preventing internal carbonization of the nozzle. The purpose of the secondary air nozzles is to introduce this air uniformly into the hot central core of the primary air stream. The final production combustion chamber reportedly had a combustion efficiency of 92 to 95 per cent with a total head loss of 0.15 atm (3 atm inlet). The maximum to mean temperature ratio was in the order of 1.2 to 1.

Fig. 10 shows the temperature distribution at the nozzle end of the combustion chamber. This temperature distribution spread obviously is quite good.

The BMW engineers revealed that, while they considered the combustion chamber just described a satisfactory initial model, they were still dissatisfied with many of its characteristics, notably the circumferential temperature distribution which apparently still could stand improvement. Another defect was the occasional complete carbonization of the space between

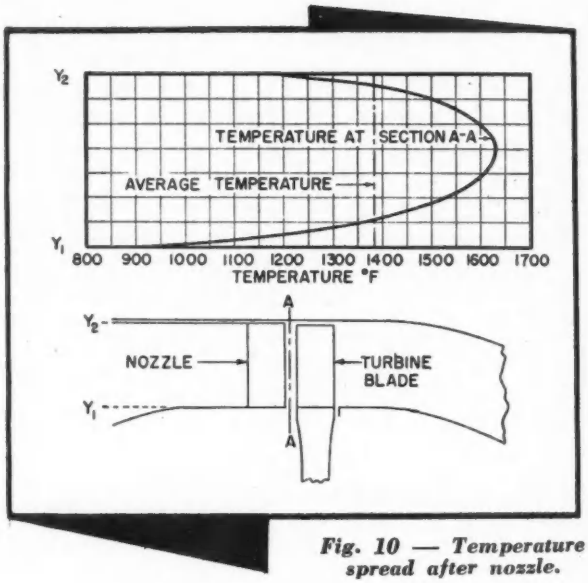


Fig. 10 — Temperature spread after nozzle.

the burner cone and the little internal cone surrounding the fuel spray. (See Fig. 8.) This was apparently an erratic occurrence for which no explanation was available except that it may have been the result of incorrect fuel spray cone angle. The blowout characteristics at altitude were unsatisfactory and it was not possible to restart the engine above 12,000 ft.

Turbine Performance

In order to minimize the risk of failure with the turbine design, both the BMW and the Junkers engineers selected single-stage turbines for their early models. The low compressor pressure ratio of these machines was partially the result of this decision. The first experimental designs used almost pure impulse blading, but the production models of both the 003A and the 004B were of the partial reaction type, with about 20 per cent reaction at the design point. Approximate vector diagrams for both units are shown on Fig. 11.

The turbine efficiency of the 003 turbine is shown on Fig. 12. The two lower curves represent the design

curve and the actual test results. Evidently the degree of reaction present in the final machine was greater than the design had anticipated, as indicated by the fact that peak efficiency occurred at a higher velocity ratio. This was undoubtedly disappointing to the Germans as it dropped the efficiency in the operating range about 1.5 per cent. The value of u/c_o used here again reflects German presentation methods not universally employed in this country. The quantity u is the familiar pitch line velocity of the buckets, but c_o is the theoretical velocity equivalent to the total isentropic energy drop of the stage, rather than the nozzle spouting velocity.

The two curves just discussed were based on the static discharge pressure, while the high dashed curve is an estimation of the efficiency values obtained on the basis of total pressure drop, that is, assuming that the leaving velocity is completely useful in the jet nozzle.

Miscellaneous Operating Characteristics

In addition to the preceding principal performance characteristics, the 003 engine had the following miscellaneous characteristics which are of interest.

a. Combustion starts between 800 and 1200 rpm but starter engine remains engaged to 2000 rpm. Idling speed is 3000 to 3500 rpm.

b. Acceleration, 3500 rpm to 9500 rpm in 11 sec.

c. Production fuel nozzle flow tolerances were ± two per cent from the design flow when tested at 40 atm pressure.

d. Fuel pressure—Gasoline 25 atm
Diesel Oil 40 to 50 atm
J-2 Fuel 50 to 56 atm

e. Cooling air to turbine blades and stator blades was approximately two per cent of total airflow.

f. Vibration of the hollow turbine blades was an early development trouble but was alleviated by the addition of the internal air deflector and damper.

g. Turbine wheel life was 60 to 80 hr, although some wheels lasted 120 hr before blade failures. Design life based on blade growth was 300 hr.

h. Fundamental shaft vibration frequency was above operating speed.

i. Manhours to manufacture, approx. 500.

j. Applications:

Production airplanes—He 162 fighter.

Experimental airplanes:

Arado 234C light bomber
Ju 287 medium bomber
Me 262 fighter and light bomber
Me 264 heavy bomber

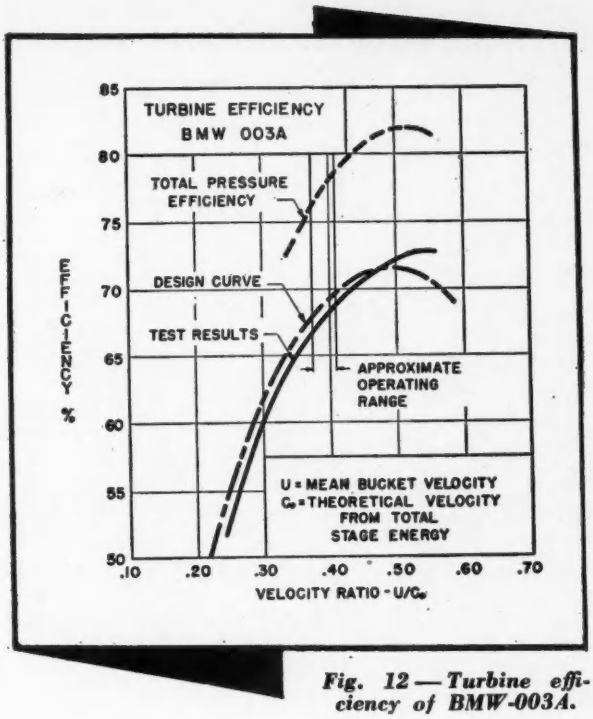


Fig. 12 — Turbine efficiency of BMW-003A.

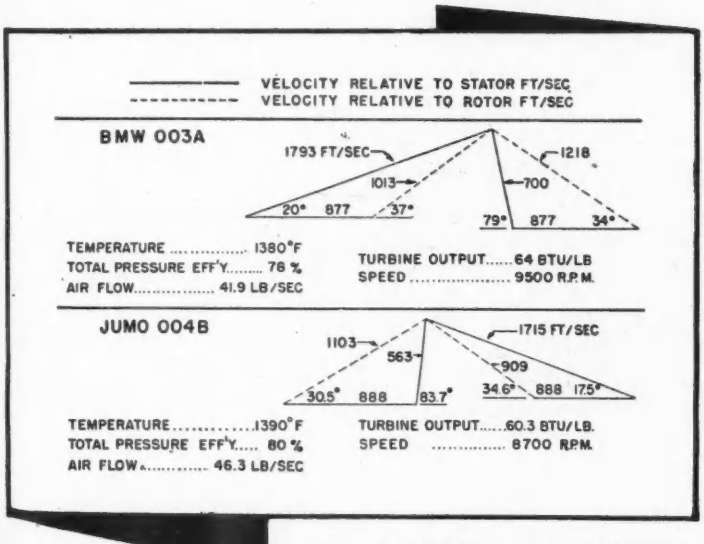


Fig. 11—Turbine vector diagrams.

As mentioned before the two models discussed herein were not the last word in German design but actual production machines, and as such were somewhat crude in the opinion of the research minded engineer. However, the wealth of test data obtained during their development was of inestimable value for the practical design and performance information provided. Naturally, this experience was incorporated in the later designs and the many detailed reports on the BMW 018[1], and 028[2], the Jumo 012[3] and 022[4] and other purely design models reveal how the German engineers planned to overcome the defects of the earlier machines. Since the Germans were considerably advanced in the gas turbine field, it is beneficial to any engineer working on similar projects to peruse the available information in these captured documents as the vicarious experience so obtained may help him to avoid some of the less obvious pitfalls surrounding these so-called simple machines.

[1] BMW 018—Large turbojet—7600 lb static thrust.
[2] BMW 028—Propeller turbine—10,000 hp at 500 mph.
[3] Jumo 012—Large turbojet—6100 lb static thrust.
[4] Jumo 022—Propeller turbine—800 hp at 500 mph.

Packard Marine Engine

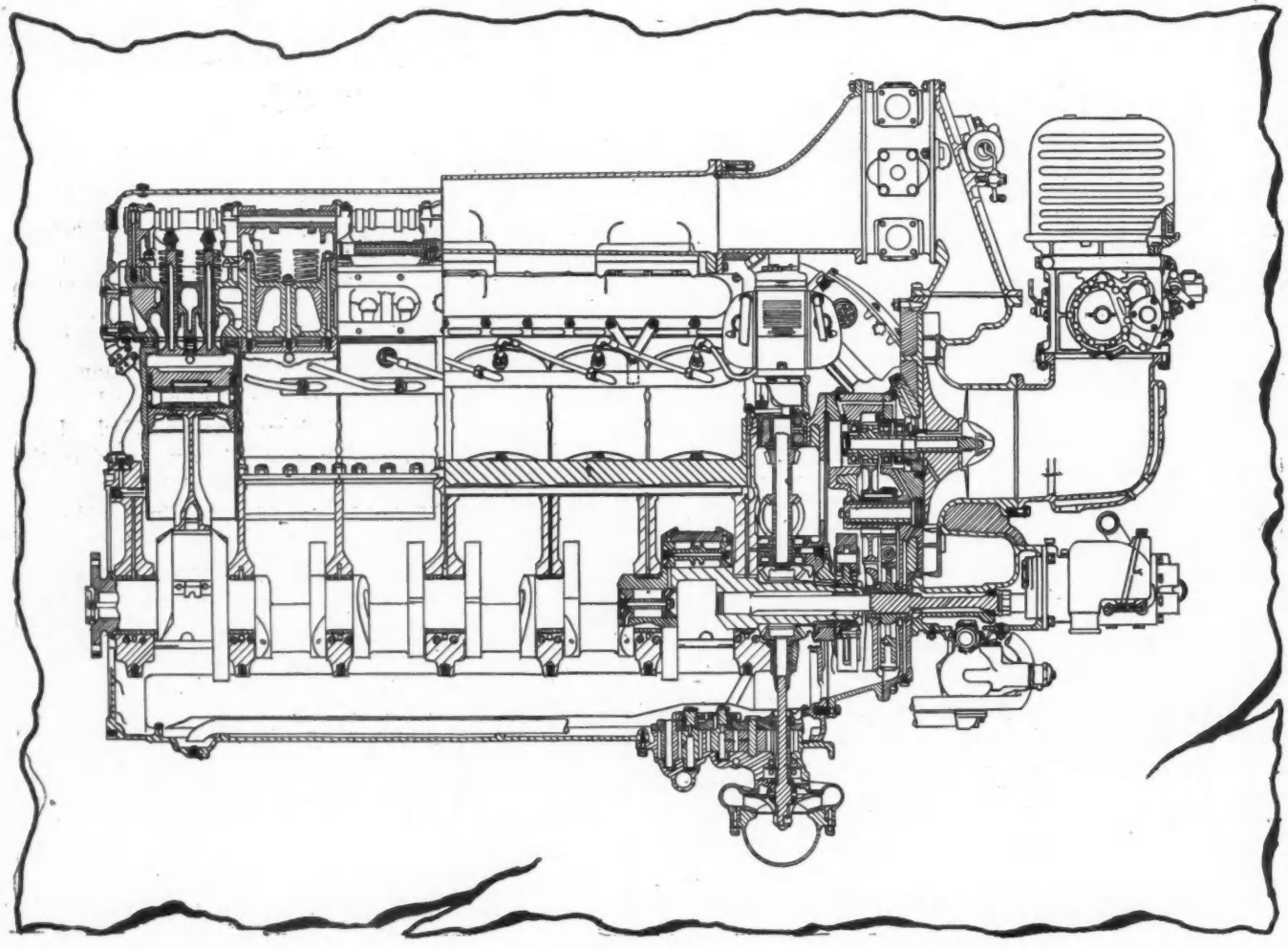
Power Output Increased

by Resourceful

AMONG the noteworthy high performance engines in wide use during the war was the Packard marine engine whose performance in the almost legendary PT type craft of the U. S. Navy is a matter of historic record. The latest edition of this engine—Model 5M-2500 Type W-50—has an emergency rating of 1800 hp at 2800 rpm; and a maximum rating of 1500 hp at 2500 rpm. Actually, these military ratings are quite conservative in keeping with wartime requirements, and the engine is capable of developing power in excess of these ratings.

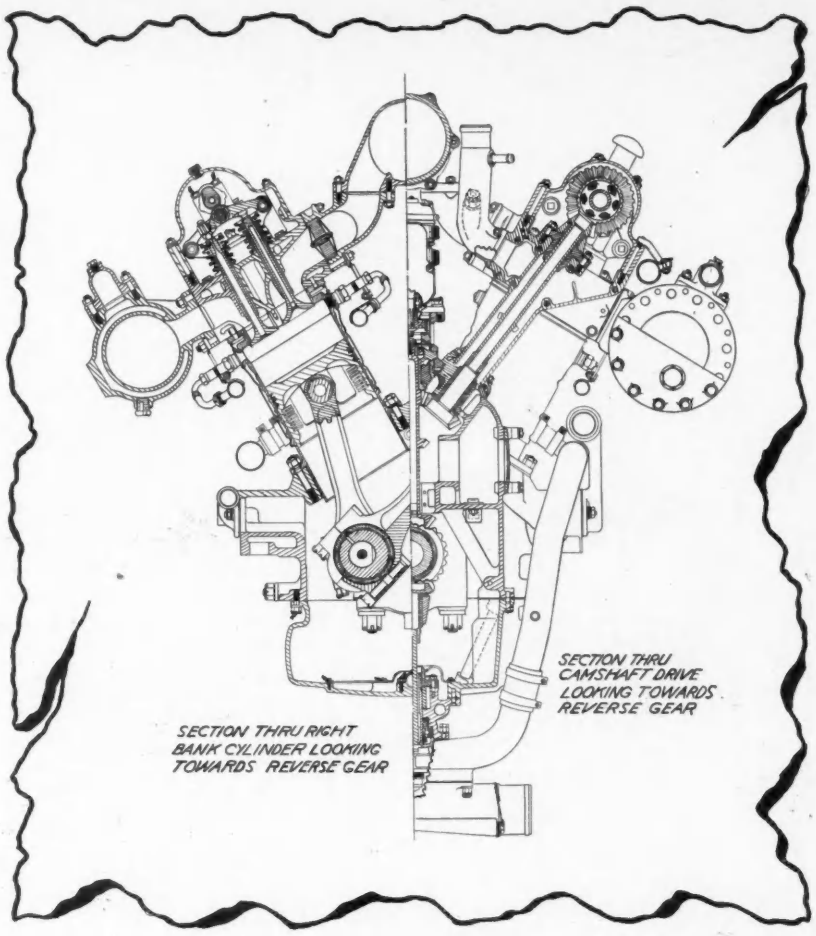
While distinctive in design detail, the Packard marine engine will be recognized as having structural characteristics of the general nature of the modern liquid-cooled, V-type aircraft engines and, by the same token, uses aircraft engine type accessories such as the carburetor, fuel pump, ignition, etc. In other respects, it follows Navy specifications required for military marine service—salt water circulating pump, heat exchanger, reverse gear, and other details. It is important to observe that the weight of the engine, complete with reverse gear, of 3100 lb includes marine engine features and should not be taken for direct comparison with the specific weight of a type of

Longitudinal cross-section of the Packard engine highlighting the accessory drive and arrangement of supercharger, water pump and fuel pump at the front end of the crankcase.



50 per cent

Engineering



Section through right bank cylinder and camshaft drive, looking toward the reverse gear end.

engine designed for aircraft.

From an engineering standpoint it is pertinent to note that this engine has gone through an evolutionary cycle of progressive improvement and development leading to refinements in construction and in manufacturing practice. The general effect of the program may be summarized briefly by recalling that the first edition built for the Navy had a nominal maximum output of 1200 hp. This compares with the present emergency rating of 1800 hp., an increase in output of 50 per cent. This relatively enormous increase in output was achieved without changing bore and stroke and without significant change in other important basic dimensions.

However, the situation does reflect the inherent potential capacity of the engine which was brought out by the refinement of detail, development of improved process, and more recently by increasing the speed of the supercharger and the introduction of an aftercooler.

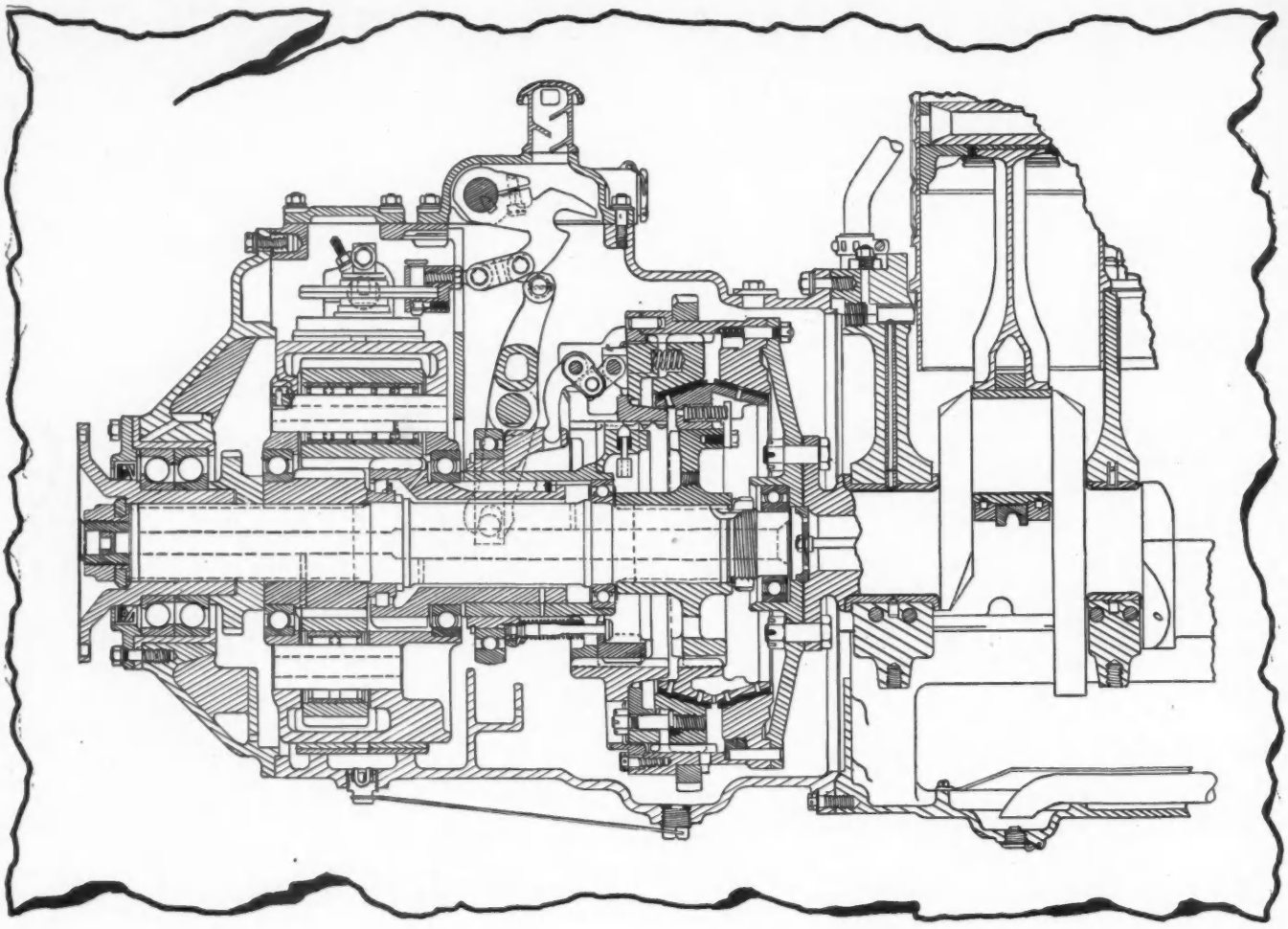
Consider now the specifications of the current model. It is of overhead valve type, 12-cyl., 60 deg V, 6⅜ in. bore by 6½ in. stroke, 2490 cu in. displacement, compression ratio of 6.4 to 1, with 100-octane gasoline. Power rating (military) is given below:

Emergency: 1800 hp at 2800 rpm (corrected for barometer and temperature to 30 in. Hg and 60 deg F.).
1700 hp at 2800 rpm (corrected for barometer and temperature to 29 in. Hg and 100 deg F.).
Maximum: 1500 hp at 2500 rpm (corrected for barometer and temperature to 30 in. Hg and 60 deg F.).
1400 hp at 2500 rpm (corrected for barometer and temperature to 29 in. Hg and 100 deg F.).
Maximum cruising—1050 hp at 2000 rpm, normal operation.
Slow cruising—400 hp at 1200 rpm, normal operation.
Minimum Cruising—150 hp at 800 rpm, normal operation.

Major accessories include — Scintilla double-spark high tension magneto mounted vertically in the Vee with two separate high tension distributors and two spark plugs per cylinder, each set independently controlled by a separate ignition switch; radio shielding with metallic harness provided with threaded outlets; Pesco rotary vane engine driven aircraft type fuel pump with automatic by-pass relief valve; and Holley aircraft type carburetor.

Let us now consider the design details with the aid of the several cross sections reproduced elsewhere in the article. The crankcase is composed of two aluminum castings joined below the crankshaft center line. The deeper upper member is of modified box section and carries the main bearings independently of the lower section. Main bearing caps are of special V-design and attached to the upper member by bolts passing through the crankcase to clamps reacting against the cylinder base flanges, also by transversely disposed tie bolts passing through the sides of the upper member. The reverse gear end of the crankcase terminates in a large flange for direct connection to the reverse gear case.

The crankshaft is of forged high alloy steel, heat treated, and has six counterweights and seven bearings. Main journals are 3.5 in. in diameter while crankpins are 3.25 in. diameter and bored out for lightness. The cheeks are drilled for pressure lubrication to the connecting rod bearings. Main bearings are steel backed precision type lined with aviation grade silver bearing alloy and securely fastened against rotation and axial movement. Crankshaft



Longitudinal section at rear of engine with detail of reverse gear.

thrust is taken by flanges on the No. 1 main bearing shells. It is of interest to note the early type engines were fitted with copper-lead bearings, the change to silver alloy contributing to the ability to increase the performance of the engine.

A pendulum type vibration damper is installed at the forward end of the crankshaft, within the engine proper, immediately behind the gearing for driving the supercharger. This damper takes care of three orders of vibration and limits torsional vibration to acceptable values. The rear end of the crankshaft has a large flange for attachment to the reverse gear clutch drum.

Following aircraft practice there are twelve individual cylinder barrels made of drop forgings of closed end type, the barrel thus containing an integral cylinder head. The outer surface of the barrel is plated to resist corrosion. The combustion chamber end is shot blasted on the outer surface to increase fatigue resistance. The exhaust valve seats are of inserted type faced with Stellite.

Each of the cylinder barrels has welded to it a steel water jacket which provides the annulus for cooling water. Present design of water jackets marks a great advance and an improvement over the earlier type and is one of the elements contributing to the higher rating of the engine. The present design incorporates marked improvements in welding techniques and features a series of circumferential corrugations which play a part in absorbing hydraulic shock. Each of the jackets is tested for hydraulic pressure to prove the welded joints and, in the process, undergoes a permanent set. When the high test pressure is released, initial compressive stresses are established in the jacket and this effect is instrumental in resisting fatigue. The barrels are attached to the upper crankcase member by an arrangement of aircraft type cylinder hold-down studs and the long bolts which support the crankshaft bearing caps.

Connecting rods are of fork-and-blade type of I-section, forged from high grade alloy steel, heat treated, and shot blasted all over. It is claimed that Packard was among the first engine builders to employ this treatment. The big end bearings are of precision type, steel backed and lined with aviation grade silver alloy, and securely fastened against rotation and axial movement. The small end is fitted with a bronze bushing.

Pistons are aluminum alloy forgings internally

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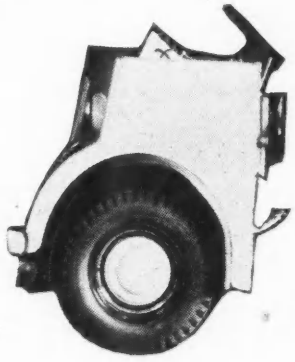
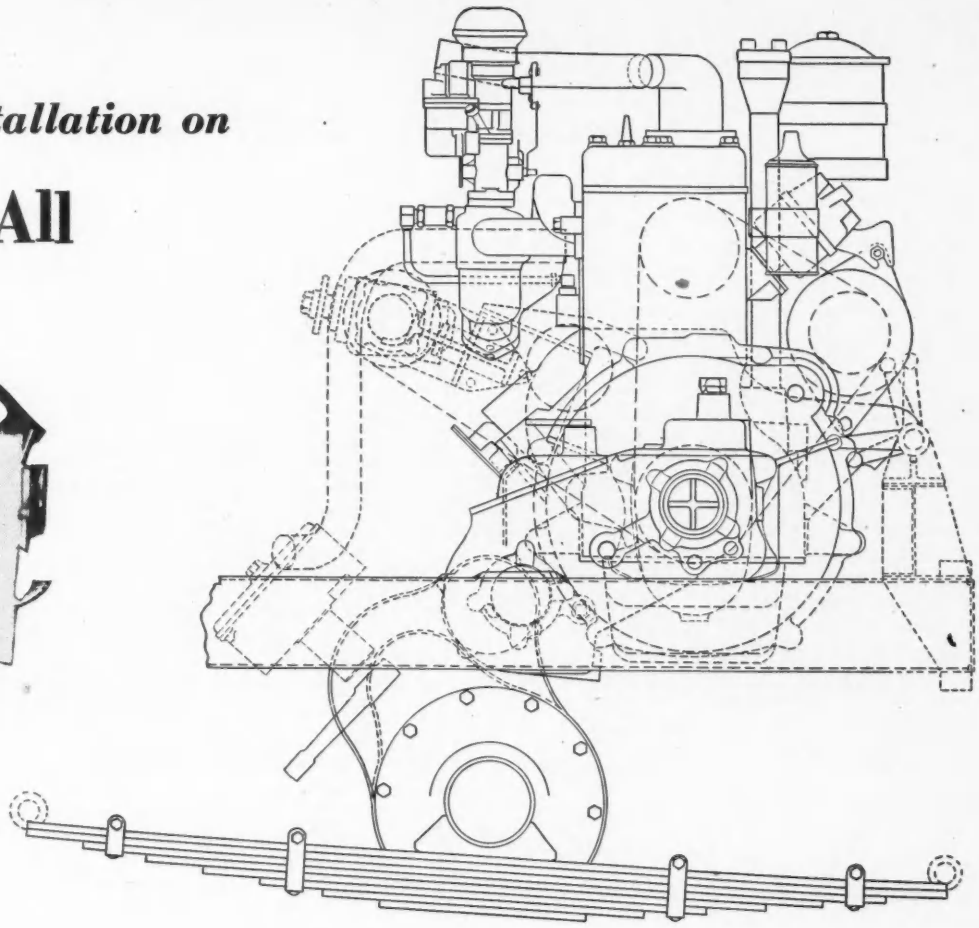
Power Plant Installation on

M-H Delivr-All Truck

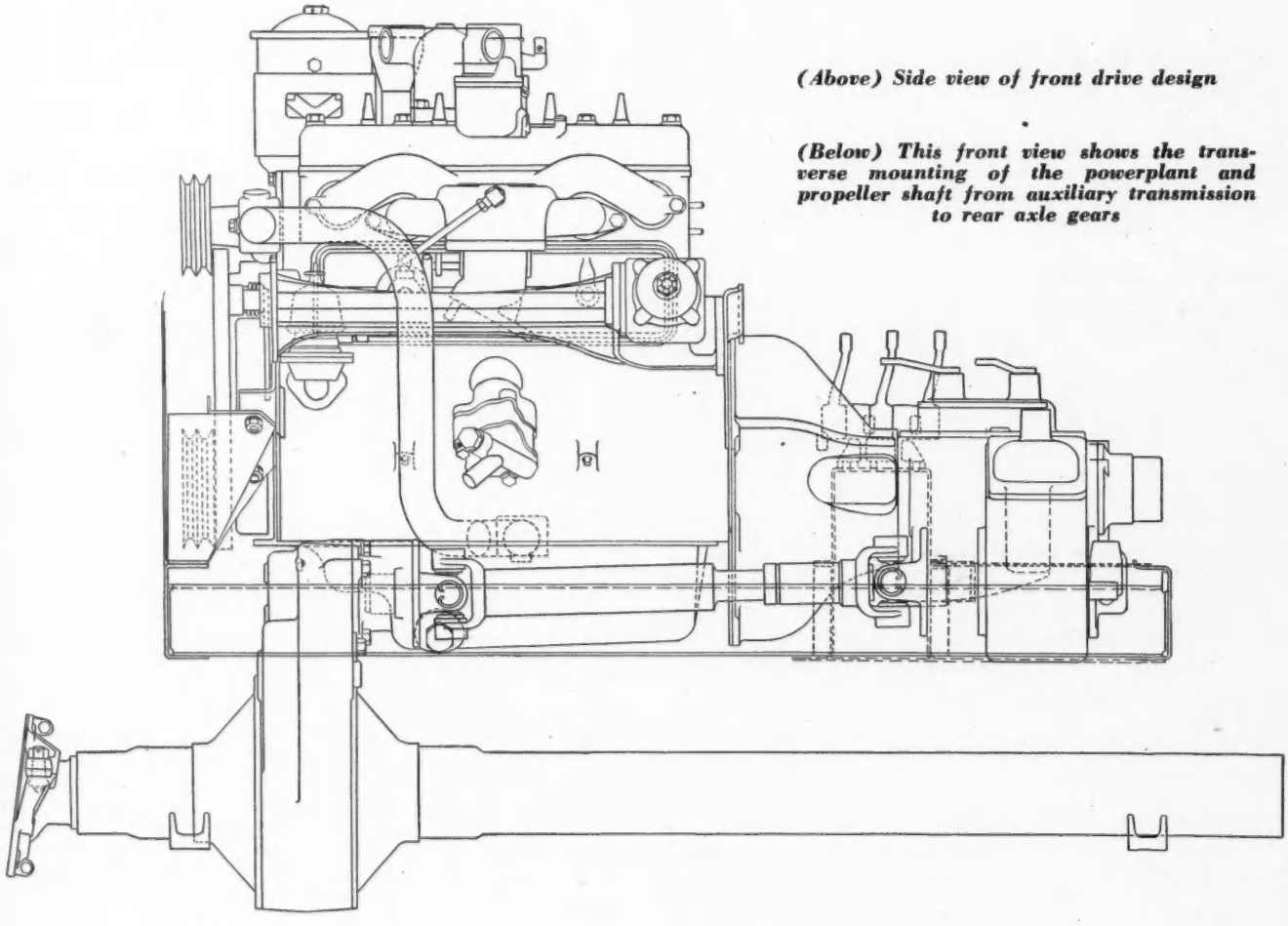


For description of this truck, see Nov. 15, 1945, issue of AUTOMOTIVE *and* AVIATION INDUSTRIES, page 22.



(Above) Side view of front drive design

(Below) This front view shows the transverse mounting of the powerplant and propeller shaft from auxiliary transmission to rear axle gears



More Abstracts of Papers Presented at the S. A. E.

Light Aircraft Service Experience With All-Purpose Fuel

by Robert V. Kerley
Aeronautical Research Department
Ethyl Corp.

IN ORDER to explore more fully effects of fuel and oil on valve materials and on combustion chamber deposits, engine tests were started in the Ethyl Corp., Engineering Research Laboratories, in cooperation with the Lycoming Division and the U. S. Army Air Forces. All tests were conducted on an 0-290-C engine for 110 hr duration, and conformed generally to requirements of the Aircraft Engine Qualification Test, AN-9502-C, omitting the sixth and seventh periods. Almost half of the testing was at full throttle. The motor fuel used was 2-103B Prototype, which was a marginal quality product, having an inhibitor content very near the maximum permitted. The 2-104B lubricating oil used throughout the tests, is considered to be a high quality product. Counterbored bronze exhaust valve guides and exhaust valve seat inserts conforming with Fig. 1, were used. The engine on which the tests were conducted was equipped with fast leak-down hydraulic valve lifters. Spark plug performance was checked during each test to determine electrode gap growth and to observe resistance and sparking voltage at the end of each test.

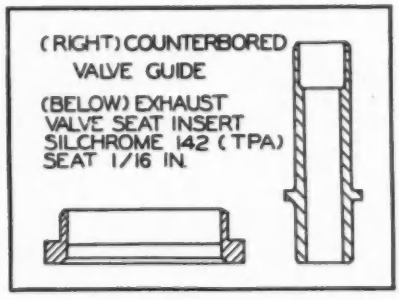


Fig. 1—Valve guide and exhaust valve seat insert used in test of light aircraft engine.

No significant difference between tests was noted.

In summary of the tests conducted, it may be stated that:

(a) Changes in valve materials from those used by the engine manufacturer did not produce a marked improvement from corrosive attack except when Brightray valves with sodium-cooled stems were used with increased valve stem lubrication.

(b) Grade 1100 aviation oil in combination with aviation fuel resulted in cleaner piston skirts but increased carbon formation around valve springs and stems.

(c) Increased combustion chamber deposits were obtained with 1-T Mix (aviation) Ethyl fluid, either in the 2-103B Prototype fuel base or in the aviation fuel base, than was obtained with the motor mix fluid.

(d) There is some indication that valve corrosion pitting is increased by the use of 2-103B Prototype fuel and that this increased corrosion is independent of the type of Ethyl fluid mix. It is possible that the decrease in the pitting type valve corrosion using the leaded aviation fuel, was due to the higher octane number of this fuel. Lycoming has independently reported that valve corrosion is greater with two other 2-103B fuels than is obtained with higher lead content aviation fuels.

(e) Use of release type valve rotators had no marked effect on severity of valve corrosion. Their effect on valve stem scuffing with the softer valve stem materials has not been but should be determined.

(f) There is little if any difference in spark plug performance associated with a change from aviation mix to motor mix Ethyl fluid in this engine under the condition of testing reported.

Two factors of importance should be noted, while no valve face or valve seat burning has been experienced, there is evidence of some exhaust valve leakage. There has been no valve sticking during these tests. The exhaust back pressure on the engine as installed on the test stand is from 1.4 to 1.8 in. of mercury which is appreciable for light aircraft engines. This back pressure may be a factor in causing detonation which has been noted during certain periods in all tests. Both the back pressure and detonation probably increase valve temperatures and this increase may have been a factor in producing the valve etching. The effect of this back pressure should be investigated prior to installation of aircraft mufflers.

It is important that the exhaust valves of any engine expected to utilize leaded gasoline be operated below the temperature which will permit rapid metal loss from combined corrosion and erosion. A comparison of corrosion resistace of one group of valve steels is illustrated in Fig. 2. It will be noted that at any operating temperature above 1200 F, only a relatively small decrease in corrosion loss can be obtained by changing the valve steel unless drastic steps, such as fabrication of valves from materials used for valve facing, is attempted.

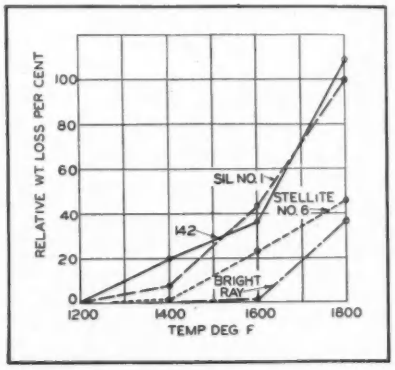


Fig. 2—Corrosion of valve steels by lead oxide. (From ASTM paper "Exhaust Valve Material for Internal Combustion Engines" by S. D. Heron, O. E. Harder and M. R. Nestor.)

High exhaust valve temperatures may result from any one of several factors including improper combustion (detonation or preignition), leakage past the valves or inadequate valve guide boss cooling.

There is no reason to doubt that suitable changes in the metallurgy and design of aircraft engines for the personal aircraft can be made to permit satisfactory operation on fuels containing concentrations of tetraethyllead permitted in Grade 80 all-purpose fuel.

Summer Meeting

In the June 15 issue of AUTOMOTIVE *and* AVIATION INDUSTRIES *on page 34 there are abstracts of other papers presented at the Summer Meeting.*

Whether these engines and aircraft should be designed to operate satisfactorily on "House Brand" or "Premium" motor gasolines may be debated. If the obstacle to proper assimilation of tetraethyllead is overcome, the major objections to use of motor gasoline then become vapor pressure, volatility and the variable quality both in terms of antiknock value and in terms of chemical composition of the fuel.

High-Speed Camera Study of Spark-Ignition Engine Knock

The Roles of Detonation Waves and Autoignition in Spark-Ignition Engine Knock as Shown by Photographs Taken at 40,000 and 200,000 Frames per Second

by Cearcy D. Miller, NACA
Aircraft Engine Research Laboratory

THE National Advisory Committee for Aeronautics has been using high-speed motion-picture photgraphy in research over a period of more than 20 years and has applied this method to the study of combustion within engine cylinders since 1933. It is the purpose of the present paper to offer a unified report of the facts concerning spark-ignition engine knock that have been previously reported on a restricted basis and to include as an introduction to the unified report the results of a literature study which the author believes support the new concept of knock that he and his coworkers have obtained from the high-speed pictures.

The findings of the NACA photographic knock investigations at camera speeds of 40,000 and 200,000 frames per second over the period from 1939 to 1946 may be summarized as follows:

Normal nonknocking combustion involves an entirely smooth travel of the flames through the combustion chamber and a smooth gradual fadeout of the combustion zones after completion of the flame travel through the chamber. The photographs have also indicated that normal combustion involves a zone of continuing combustion behind the flame front with a depth measured in tenths of an in.; the combustion zone, however, may have a cellular structure. Preignition from a hot spot is not a direct cause of knock and the flame from a hot spot is similar to the flame from a spark plug.

Vibratory knock has been shown to involve an extremely fast reaction, termed the "explosive knock reaction," which develops suddenly after a period of normal burning. This reaction involves a time interval not greater than 50 microseconds. The explosive knock reaction has been shown to begin within 25 microseconds of the same time as the violent knocking vibrations shown by a piezoelectric pickup placed in the end zone of the combustion chamber. The photographs have indicated that the explosive knock reaction originates only in a portion of gas that is already ignited, either by normal flame travel or by autoignition.

The photographs have shown a number of different types of end-gas autoignition, some of which appear always to be followed by the explosive knock reaction and some of which may occur without being followed by the explosive knock reaction. Cases of the explosive knock reaction not preceded by any form of autoignition have been observed.

Analysis of the photographs taken at 40,000 frames per sec has indicated that the explosive knock reaction is a type of detonation wave traveling, under different conditions, at speeds ranging approximately from 3000 to 6500 fps or from about one to two times the speed of sound in the burned gases. The propagation speed of the order of 6500 fps for the explosive knock reaction has been confirmed by the one series of photographs obtained at 200,000 frames per sec.

A definite loss of chemical energy that would otherwise have been available has been shown to result from the explosive knock reaction. Free carbon is released in both the burning and the burned gases within 10 microseconds after passage of the detonation wave associated with the explosive knock reaction.

The indications of the high-speed and ultra-high-speed photographs do not harmonize with the simple autoignition theory of knock or with the simple detonation-wave theory. They appear rather to support the combined detonation-wave and autoignition theory proposed in the literature discussion that forms the first part of the original paper.

Aircraft Engine Starters

by Arthur Beier
Jack & Heintz, Inc.

IN VIEW of the difference in the starting characteristics between the reciprocating and jet types of engines, it is believed that a definition of a satisfactory jet start would be helpful. A satisfactory start is one in which the engine has been turned over to such a speed that it is not only able to sustain itself and overcome its own friction, but in addition, it is able to accelerate itself to rated speed. The start must also be accomplished in a reasonable period of time which will vary with the operational use and the size of the engine involved.

The rapid acceleration required to accomplish a satisfactory start in accordance with the definition, makes the inertia loads of both the rotor and possible propeller especially important. The moments of inertia of turbo jet and gas turbine engines vary from 20 lb ft² up to 1200 lb ft²,* the latter moment of inertia being almost identical

* Some of the larger units being developed may exceed this value.

with that of a typical 2000-hp reciprocating engine along with its associated propeller. The importance of the inertia load factor on starter design is obvious when considering that the large turbo jet engine having the same moment of inertia as a conventional engine must be rapidly accelerated for starting to almost twice the normal rated speed of the conventional engine. This load is in addition to that of the air load of the turbine and compressor at the starting speeds. Unlike the corresponding reciprocating engine, the gas turbine air load increases as the square of the engine cranking speed and therefore, it also represents an important factor in starter design considerations.

The low temperature starting limits for jet engines is −65 F, the same as for reciprocating engines. The use of lubricating oils having a lower viscosity and a more nearly constant viscosity index than those used in reciprocating engines is of considerable help in this respect. However, data taken to date indicates that the starter power requirements for jet units increases approximately 200 per cent between 60 F and 0 F. Therefore, starting temperatures also become a problem which must be considered in the design of a starter.

Cranking speed is closely related to the requirement that the engine must develop sufficient power to overcome its own friction and accelerate itself to the desired operating rpm. It appears from present designs that most of the jet units can be ignited and will start in assisting the starter to a greater or lesser extent at approximately 15 per cent of rated speed; however, this ignition speed is below that at which the starter can be released and from this ignition speed the starter and turbine in combination must accelerate the engine up to the minimum idling speed or speed at which the engine can accelerate itself without the use of the starter. With present designs, this minimum idle speed varies from approximately 30 to 45 per cent of rated turbine speed. In some cases, there is also an intermediate speed between that of ignition and minimum idling at which the engine will be self-sustaining, but is incapable of accelerating itself.

The minimum speed at which a jet engine can accelerate itself is primarily dependent upon basic characteristics of the particular turbine efficiency at various speeds. At the present time, most research is bent toward obtaining the highest efficiency at rated turbine speed and with little regard for the efficiency obtained at the lower speeds; however, it is considered doubtful whether much improvement can be effected in low speed efficiencies because of basic turbine characteristics. Therefore, it cannot be anticipated that additional research of turbo jet engines will appreciably reduce the necessary high rotated starting speeds in the neighborhood of 3000 to 5000 rpm, depending upon the unit under consideration.

The objection to the high cranking speeds for turbo jet engines is not in the rpm itself but rather in the large power requirements they represent. At 60 F one of the smallest turbo jet engines, which develops approximately 1500 hp at present airplane speeds, requires an electric starter having a peak output of approximately 20 hp and a minimum output at the end of the acceleration period of approximately 9 hp. In comparison the conventional 2000 hp reciprocating engine requires only about 2 hp under the same conditions. The moment of inertia of the jet engine used in this illustration was only 12 lb ft^2 and the larger jet engines now under development will have a corresponding increase in starter power requirements. Although accurate power requirements are not available for the larger units, estimates indicate they will require starters having outputs of approximately 150 to 200 hp. Since the maximum power requirements for the largest reciprocating engines is only 6.5, the starting means for jet engines must be given an entirely new analysis and consideration since previous aircraft starters furnishes no guide line in this respect.

The jet engine starter must also be capable of effecting a start up to the service altitude ceiling of the airplane. Although available altitude information is somewhat meager, tests indicate that both centrifugal and axially flow type turbo engines have a higher minimum idling speed at altitude than at sea level; however, sufficient wind milling speed is obtained to materially reduce the total starter power requirements.

Survey of German Diesel Engine Development

by C. G. A. Rosen
Caterpillar Tractor Co.

IN ALL the more modern Diesel engine designs observed, the centrifugal type supercharger was employed either direct gear driven or by means of an exhaust gas turbine. The two cycle developments are included in this category because some measure of increase in pressure over atmospheric was employed in each case. In one two-cycle aircraft design (Deutz) a boost to the main blower was considered where an exhaust turbine driven unit was to be used as a first stage, the net result providing supercharging to the cylinder. In large MAN single screw cargo ships the piston type scavenging pump is preferred in order to make the main propulsion unit self-contained and is permissible where space is not a serious factor. The main objection to a Roots type blower, for high-speed Naval engines, was the weight and space factors and to some extent, noise.

Several thoughts were expressed as to methods of silencing the suction to the centrifgual supercharger. Daimler-Benz determined the proper tip clearance between the impeller and the diffuser in such a way that they obtained satisfactory reduction in noise level. MAN utilized a type of combined air cleaner and silencer which they claimed reduced suction noises below the engine noise level. They have developed a unit, provided with screens filled with treated wood shavings, ahead of the blower.

In construction for simplicity of mounting and sealing, both Daimler-Benz and MAN prefer a double vane type impeller. In very large units, MAN weld and rivet these impellers and obtain over 80 per cent efficiency.

In all cases isolation of torsional vibrations from either the crankshaft amplitudes or from blower excitation is obtained by the use of some spring type of damper preferably placed near the crankshaft and before the impeller shaft.

The degree of valve overlap from inlet valve opening to exhaust valve closing in four-cycle engines varies, depending upon the degree of cooling desired by blowing cool air over the piston crown. The Daimler-Benz engine uses 100 deg overlap. This modification is probably made because the blower is gear driven from the drive end of the crankshaft. Therefore it does not recover compressor losses from the engine such as is the case in the MAN type MV 40/46 engine where the unit is an exhaust gas turbo compressor. The MAN overlap in the above engine is 140 deg crankangle. This value, however, is reduced, when Schorchel operation is required, to 40 deg overlap because of the increased back pressure encountered. The turbo-blower is inoperative at such times.

In the Daimler-Benz engine the blower is provided with a hydraulically operated multi-disk clutch and the compressor is therefore only rotating when the higher loads are required. Under ordinary cruising conditions the blower is not in use and saves wear and tear both on the high-speed blower (10 x crankshaft rpm) and the engine itself.

It is the practice of Daimler-Benz to reduce the compression ratio of the supercharged engine to 14 to 1 whereas the unsupercharged engine is 16.5 to 1. At such low compression ratios it is sometimes necessary to use glow plugs in order to obtain satisfactory starting. The purpose of this is to maintain practically the same peak combustion pressure in either engine. The ignition lag is also about the same.

Aluminum Alloys for Bearings

By H. Y. Hunsicker and L. W. Kempf,
Aluminum Co. of America

AS A result of the experimental work which has been completed up to 1939, one of the promising experimental alloy compositions was selected for additional study and commercial evaluation. The nominal chemical composition of this material is: 6.5 per cent

tin, 1 per cent nickel, 1 per cent copper, the balance aluminum of commercial purity. This material was intended primarily for permanent mold castings, which by virtue of their rapid solidification are typified by a fine, dense, strong and fatigue resistant structure.

Bearings machined from permanent mold castings of this material have been extensively tested in many types of engines under both laboratory and actual service conditions. The practical experience of these tests has firmly established the applicability of a properly balanced aluminum alloy composition produced under carefully controlled manufacturing conditions for high-duty engine bearings. In addition, the service records of these bearings have verified early laboratory findings of marked superiority in several aspects of performance.

The aluminum-tin alloy bearings have exhibited consistently superior fatigue resistance under normal and unusually severe bearing pressures. The data from several tests of the cast Al-Sn-Cu-Ni alloy, steel backed 65 copper—35 lead, and steel-backed tin-base babbitt conducted in the fatigue-testing machine are plotted in Fig. 3. These

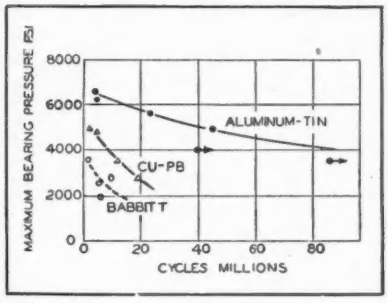


Fig. 3—Relative endurance of solid cast aluminum alloy bearings, steel backed copper-lead, and steel backed babbitt in the fatigue testing machine. The curves for copper-lead and babbitt are based on a reduction in bearing area of 20 to 30 per cent through fatigue and spalling of the lining.

tests were made under the following conditions:

Journal—2.165 in. diam, SAE 1045—225 Brinell
Finish—Ground, 10-20 microinches, rms
Speeds—3500 to 4000 rpm
Lubricant—SAE 30 motor oil
Temperature—280 to 320 F
Load Type—Sinusoidal
Bearing Dimensions:
Wall thickness—0.072 in.
Lengths—0.5, 0.75 and 1.0 in.

Various bearing lengths and eccentric weights were employed in producing the range of bearing pressures. Failure of the steel backed materials was based on a reduction of effective bearing area through spalling or fatigue of the lining metal amounting to 20 to 30 per cent. The superiority of the aluminum alloy in these relatively short-time laboratory conditions have substantiated this conclusion, and indicated that bearing life may be increased by the use of aluminum bearings from 200 to 500 per cent over that attained by high quality copper-lead, cadmium base or "micro-babbitt" bearings. It is commonly recognized that the fatigue life of ordinary types of cast bearings is a definite function of casting quality, and it has been demonstrated that the endurance of the cast aluminum alloy bearings is adversely affected by certain types of unsoundness and other structural factors so that a carefully controlled foundry practice is essential for the insurance of optimum performance.

The excellent bearing characteristics have been evidenced by the superior performance of aluminum alloy bearings in engine service under extreme loads and at high temperatures. The material has demonstrated an unusual ability to function without difficulty under conditions leading to substantial shaft deflections, and there is considerable evidence that foreign hard particles which enter the clearance between the journal and bearing may imbed in the aluminum alloy to prevent accelerated abrasion of the journal.

On some occasions under extreme service conditions or when unusual amounts of particularly harmful foreign material have been present, scuffing or galling of the aluminum bearings has been encountered. In most cases this occurrence has been traceable to improper design or installation. Galling of the aluminum alloy bearings is usually accompanied by adherence of a thin film of the aluminum alloy to the shaft. Removal of this thin coating of aluminum from the steel journal by means of abrasives or dilute caustic solutions has, in practically all cases, revealed the absence of any detrimental effect on the journal surface. This has been demonstrated by making highly magnified surface profile patterns of the journal before the occurrence of scuffing and after removal of the adherent aluminum film.

The high resistance of the aluminum-tin alloys to corrosive attack by the organic acids formed on the breakdown of lubricating oils during use, as shown in Fig. 4, is a definite advantage and leads to the possibility of using compounded oils in engines where previously corrosion of bearings made it impractical to take advantage of the superior properties of such oils. Compounding to increase the lubricating qualities of the oils or to prevent accumulation of engine deposits, ring sticking, etc., is made possible by the improvement in the chemical stability of the bearings.

The observation and repeated confirmation of the improvement in resistance to scuffing contributed by the addition of silicon to the aluminum-tin alloys led to intensified work on the effects of this element in bearings. Considerable investigation of aluminum alloys containing various proportions of tin, silicon. nickel and copper, along with commercial impurities, was involved in the selection of an alloy of the following nominal chemical composition: 6.5 per cent tin, 2.5 per cent silicon, 1.0 per cent copper, 0.5 per cent nickel, the balance commercial purity aluminum. This material retains all the superior properties of the Al-Sn-Cu-Ni alloy together with a distinct

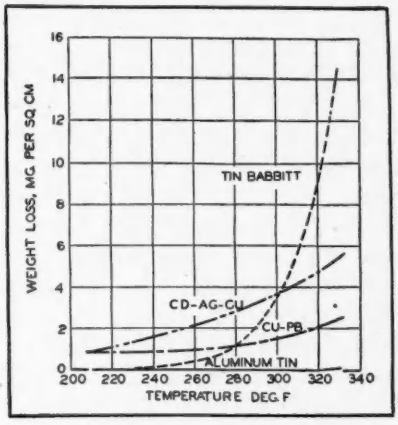


Fig. 4 — Relative corrosion resistance of bearing materials, as shown by weight losses after 65 hr exposures. Curves are average value for three different oils.

improvement in frictional and anti-scoring properties and represents a considerable advance in the development of the aluminum bearing.

No great increase in strength can be produced through heat treatment of material of this composition; however, it was found that beneficial structural changes did accrue from certain thermal treatments. Exposure to solution temperatures, 850 F and above, produces some spheroidization of the silicon particles with a resultant improvement in ductility and machinability. In addition, silicon particles of spheroidal shape are believed to be more desirable from the standpoint of bearing characteristics than the angular shapes present in the as cast structure. When the solution treatment is followed by a precipitation treatment, a moderate increase in strength is obtained.

Discussion of "Aluminum Alloys For Bearings"

By E. L. Dahlund
Fairbanks, Morse & Co.

OUR experience with aluminum-tin bearings has been in medium speed, two-cycle, heavy-duty diesel engines with bores from 5.25 in. to 8.5 in. with corresponding speeds of 1200 to 514 rpm, and ranging in power from 175 to 2000 hp. The bearings used, with one exception, have been of the solid aluminum alloy, pressure lubricated, precision type.

(*Turn to page* 68, *please*)

The

FIRST of the European post-war passenger cars to be uncovered (as distinct from the intermediary models) is the Descartes 52 designed by the French engineer Emile Claveau.

Distinctive in all its features, the Descartes 52 has among its more outstanding points a very favourable power-weight ratio, attributable both to design and the extensive use of light alloys; better streamlining than on any car yet put on the market, accompanied by big passenger and baggage capacity; front wheel drive; a grouping of all the mechanical organs, with five speed transmission and overdrive; a unit chassis-body; independent suspension all round; permanent car jacks, and a big capacity tank giving a radius of action of 500 miles. The car is the outcome of 20 years specializing on these points.

With a wheelbase of 122 inches, track 55 inches, total length 196 inches, total width 70 inches, internal dimensions of 104 inches in length, uniform width of 62 inches and height of 51 inches, the Descartes 52 has a total weight of 1984 pounds. The French car most closely comparable to it in dimensions weighs 2966 pounds and the lightest five passenger car on the market scales 2380 pounds. The weight per horsepower is stated to be 24.2 pounds, compared with 39.6 for the most favourable car at present in production.

Claveau has designed a V-eight engine of 66 by 84 mm. bore and stroke, capacity 140 cubic inches, peaking at 5,000 revolutions, and developing 85 h.p. at 4,200 revolutions. The complete weight of the engine is 198 pounds, or 2.3 pounds per horsepower. The cylinder block and crankcase are a single casting in Alpax, with heat treated liners. The two heads are also in Alpax with bronze seats for the 36 mm. valves. The bronze, which is set in the casting, comprises the two valve seats and the spark plug boss. With the valves set at 90 degrees, a perfect hemispheric highly-polished cylinder head is obtained, with a long reach water-cooled spark plug. The valves are cam opened and cam closed from overhead camshafts, with a lift of 8.25 mm., with a very light spring to prevent hammering of the valve faces on their seats. The mechanism is silent and operates completely in oil. The water pump housing is a part of the timing gear cover. Instead of the usual four hose connections on a V-eight, there is a single flexible connection on this

(Above) This three-quarter-front view shows the Descartes 52 with a wheelbase of 122 inches, track 55 inches and an overall length of 196. It is built of light alloys almost exclusively except for working parts.

(Left) A front view showing the low body of this streamlined model.

(Right) Streamlined 5 passenger four-door saloon has a big passenger and baggage capacity. It has a five-speed transmission and overdrive, independent suspension and permanent car jacks.

Descartes 52

engine. It is claimed that the power required to drive the valve gear is only one fifth of that for the usual type of spring-closed valves. Another feature is that the radiator, specially designed for this job is only one third the weight of a normal radiator; it offers practically no head resistance, the power absorbed by the radiator being only 1 h.p. at 75 miles an hour, whereas on many normal cars as high as 18 h.p. can be estimated at this road speed.

The crankshaft is carried in three bearings—a centre plain and two ball bearings. The cylinders are not staggered and by reason of a patented feature each connecting rod bears on the full width of the throw, without the use of a forked end. A double oil pump is used, one portion circulating oil through the engine bearings and other circulating it through the radiator. A cast aluminum exhaust box with polished vertical fins is set in the leading edge of the airplane-wing type body, thus giving the shortest possible length of pipe from the exhaust manifold, providing maximum cooling and having a decorative effect.

Forming a unit with the engine is a transmission with five speeds and reverse, the fifth being an overdrive ratio 1.22 to 1, which gives a speed of 93 miles an hour at 4,200 revolutions. This leaves a margin of 800 revolutions. Hydraulic gearshifting is provided through a servo motor operating from the gearbox, with control centered on a small gate under the steering wheel. The gears are of the constant mesh type with dog clutches. At the forward end of the crankshaft there is a flywheel forming turbine for the cooling air directed through the radiator, and at the rear of the transmission a second flywheel for the single plate clutch of the normal type. Engine balance is considerably improved by the use of these two flywheels. Final drive is by cardan shafts to the front wheels. The compact power plant being in the order engine, differential, gearbox and clutch, is readily accessible by a hood hinged at the rear.

All four wheels are sprung independently, the flexibility being variable and progressive, and is the subject of patents. The spring mechanism is entirely enclosed. Wheels and brake drums are of light alloy, with iron liners for the brakes. A permanent jack is fitted near each wheel and is mechanically operated.

By W. F. Bradley

Special Correspondent
Automotive and Aviation Industries

Chassis and body are a unit, built according to Claveau patents, of Duralinox panels electrically welded into one rigid shell.

The Descartes 52 is a distinct departure from normal construction by reason of its streamlined form. It is claimed that its coefficient of penetration is 0.35, compared with .078 for the best streamlined car at present in production and .020 for a well designed racing car. As the illustration shows, the car adopts the form of an airplane wing, of uniform width throughout, the exhaust box being set into the leading edge, and the underpan being absolutely flat, with the two exhaust pipes attached to it and discharging at the rear. On the center of the hinged hood is a circular opening, through which air is drawn by means of a turbine, directed onto the exhaust pipes and through the radiator and discharged with the minimum amount of resistance. The front wheels are exposed, while the rear wheels are enclosed.

There is no restriction of the body space because of the streamlined form. The internal width of 62 inches is uniform throughout a length of 104 inches. In addition there is a gasoline tank of nearly 30 gal-

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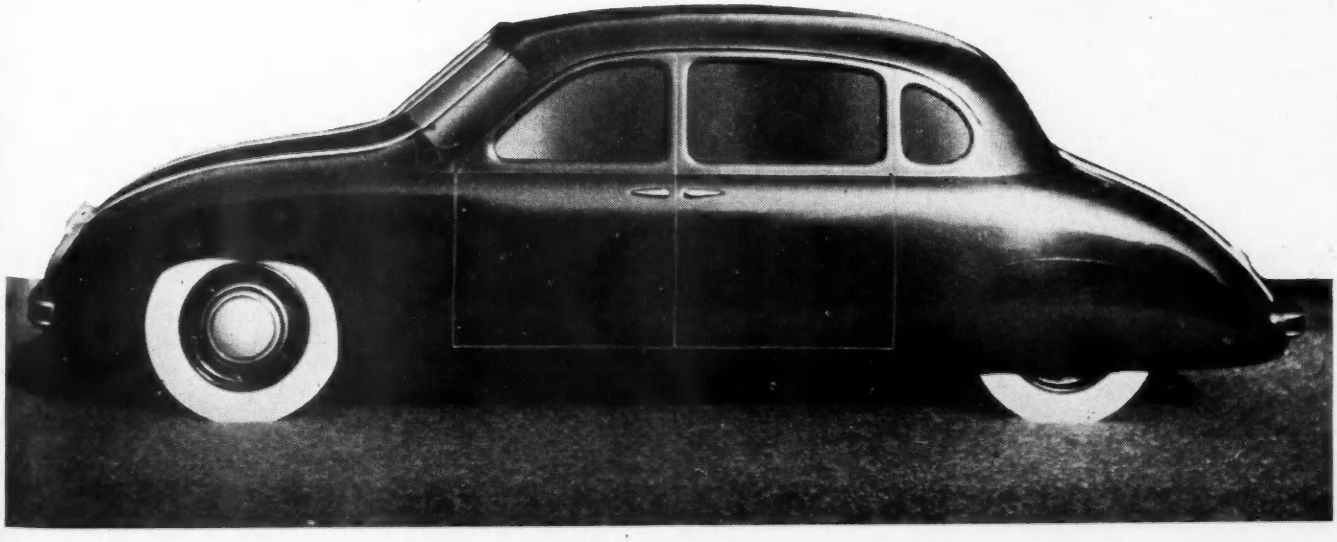
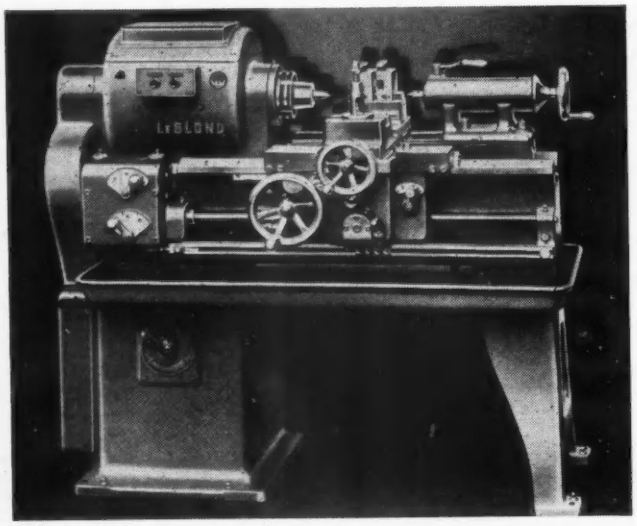




LeBlond 13-in. motor head rapid production lathe

THE R. K. LEBLOND MACHINE TOOL CO., Cincinnati 8, Ohio, has recently redesigned and is now in production on its new 13-in. motor head rapid production lathe.

The outstanding feature of this new lathe, which is designed for light cutting at extremely high speeds, is that the two essential elements of an electric motor—stator and rotor—are built integral with the headstock. Instead of the usual gears and belts, the headstock contains a stator bolted to the casting, and a rotor pressed onto the spindle. This motor head operates at 5 hp at top speed, and is said to run quietly without vibration at speeds as high as 3600 rpm.

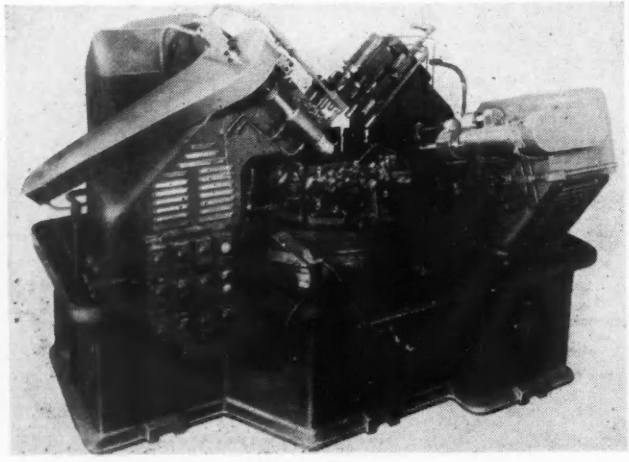
An electric start-stop box replaces the usual levers and handles. A touch of the stop button electrically brakes the spindle to a quick stop. All controls are less than arm's length from the operator, including the new finger-touch speed-change handle located in the head end leg.

Various attachments such as those used on the standard 13-in., 17-in., and 20-in. LeBlond rapid production lathes are also available for the new motor head. The range and scope of the machine may be further widened by LeBlond engineering service in designing and producing special tooling for difficult production jobs.

A SPECIAL-PURPOSE, four-stage machine for the drilling, spot-facing, counterboring and tapping of the vacuum holes in intake manifolds, has been completed by Hydraulic Machinery, Inc.. 12825 Ford Rd., Dearborn, Mich. The cycle of operation is entirely automatic except for loading and unloading.

Parts are manually loaded and clamped into position and, upon closing the safety door, electric contact is made and the machine automatically indexes to position, all heads moving forward and completing the drilling, spotfacing, counterboring and tapping. During cycling time of the heads, another part is loaded.

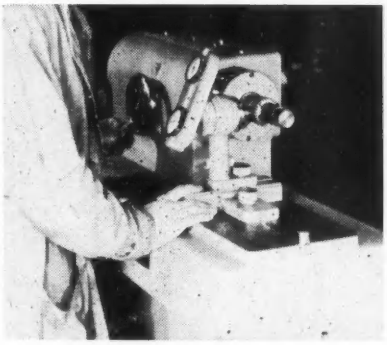
The machine is hydraulically operated and electrically controlled, and arranged with safety features, provisions being made to prevent indexing until part is properly clamped in position. All hydraulic power and control valves are mounted in the base with access doors for servicing.



Special four-stage machine made by Hydraulic machinery, Inc

A NEW line of production lead comparators for use in gear production shops has been brought out by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. Known as models 1200 and 1200A, the comparators are designed for use on the production floor alongside gear cutting and shaving machines. The master multiple thread lead, followers, indicators and actuating mechanisms are all enclosed.

The machines may be used as an aid in setting up gear cutting and finishing machines, to check gears after processing, to determine lead compensation for "unwinding" of gears during heat-treatment, etc.



Michigan 1200 lead comparator

The machines are applicable to both external and internal gears as well as worms. To change the machine over for checking gears of different leads, it is necessary only to change the master lead to one having a corresponding lead. Different gears of the same lead may be checked by the use of interchangeable mandrels, etc.

The Model 1200 lead comparator will check helices (up to 45 deg) at several points around the periphery of internal or external helical gears. For larger helices and to check the leads on worms, Michigan 1200-A lead comparators may be used. Both comparators will handle work with a maximum swing of 10 in.

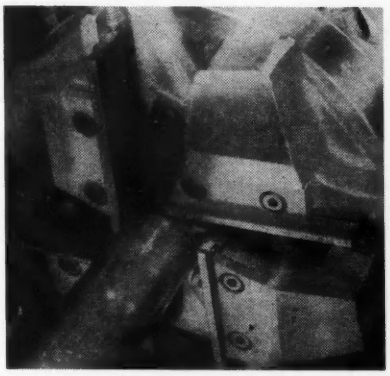
New Production and Plant Equipment

LANDIS MACHINE Co., Waynesboro, Pa., announces a centering throat chaser for work that must have threads concentric with the outside diameter. It is said to be especially adapted to the threading of valve stems and other long length threads of coarse pitches.

This chaser can be used only when the outside diameter of the work is held uniform. The outside diameter of the work must be uniform since the centering throat section of the chaser takes a bearing on the O.D. The chasers are flexible in that any difference on the O.D. can be corrected on the centering throat to maintain proper pitch diameter.

For example, if the outside diameter is .625 in. and the pitch diameter .005 in. under basic, the centering throat section of the chaser can be ground .0025 in. below the root of the thread to compensate for the difference.

In addition to holding concentricity between the thread and outside diameter of the work, the centering throat chaser eliminates an out of round condition that often exists when long work pieces are threaded, making it necessary to extend the work out from the carriage front or chuck for a considerable distance. The centering throat takes a bearing as soon as the chaser contacts the work and assures accurate and well formed threads from the start.



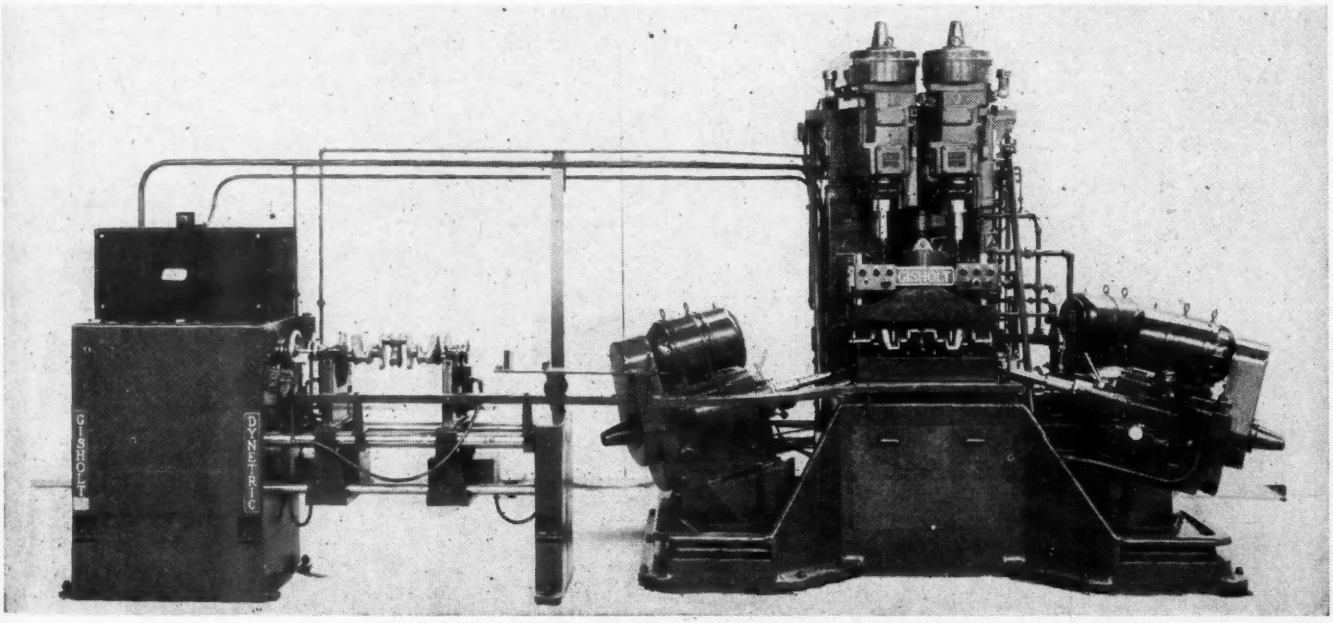
Landis centering throat chaser

GISHOLT MACHINE Co., Madison, Wis., has developed complete, semi-automatic equipment for measuring and correcting unbalance in automotive type crankshafts. The equipment consists of two electrically connected machines. The first of these machines is a Gisholt Type C Dynetric balancing machine. The second machine is a multiple-spindle drilling machine.

The balancing machine is arranged to indicate directly the amount of metal which should be removed from specific points in a crankshaft in order to produce balance. The points for unbalance correction are determined only by the limitations of the crankshaft. For example, in a four-bearing, six-throw crankshaft, corrections for balance may be made by drilling into Nos. 1, 2, 5 and 6 crankpins and into the kidney cheek between Nos. 1 and 2 crankpins and between Nos. 5 and 6 crankpins. The balancing corrections in the kidney cheek are in the radial direction of Nos. 3 and 4 crankpins. With such an arrangement of correction drilling, there are, on each end of the crankshaft, three points spaced 120 deg apart where it is possible to drill for balance. To obtain combined static and dynamic balance of any crankshaft, it is actually only necessary to drill two of the three holes in each end of the crankshaft.

The Gisholt Type C Dynetric balancing machine can be arranged to measure the exact amount of correction which should be applied at each of the six points, above described, to give both static and dynamic balance. These six balancing machine indications are electrically transmitted to a six-spindle drilling machine. In this drilling machine, the spindles are arranged so that holes can be drilled at the permissible points of correction. The depth of each hole is automatically set from the corresponding balancing machine measurement.

The first step in the balancing process is to load the crankshaft into the balancing machine from the production line. By movement of a lever, the



Gisholt semi-automatic equipment for measuring and correcting unbalance in automotive-type crankshafts

crankshaft is hydraulically lowered into position on the vibratory supports of the balancing machine. The operator attaches the balancing machine driver to the crankshaft and presses the start button of the balancing machine. The operator is now ready to measure the amount of correction to be applied at each of the six permissible points.

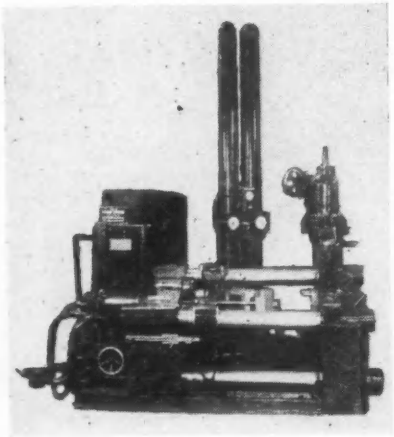
The balancing machine controls consist of a pair of selector switches and six weighing dials which are numbered to correspond with the correction points on the crankshaft. The selector switches and weighing dials are turned in sequence to cause a meter on the balancing machine to read zero. When the last weighing dial has been turned, the driving coupling is removed from the crankshaft. The crankshaft is then raised hydraulically so that the operator can easily slide the crankshaft onto a dolly. The hydraulic lift cannot function unless the driving coupling is removed from the crankshaft. The crankshaft can be moved onto the dolly only when its angular position is such as will later permit it to be moved into the driller without difficulty. When the dolly is loaded, it is unlatched and moved on to the correction drilling machine.

When the dolly has arrived at the correction drilling machine, the crankshaft is in the proper angular position to be moved directly into the driller. The crankshaft can enter the drilling fixture in only one angular position so that it is positioned properly for correction drilling.

The correction drilling cycle is started by simultaneously pushing two start buttons, one with each hand. The drilling cycle actually consists of: (1) Properly locating the crankshaft in an endwise position by hydraulic means, (2) Firmly supporting and clamping the crankshaft in the fixture, (3) Bringing up hydraulically operated wedges against the roughed forged surfaces of the crankshaft to provide support against drill thrust, (4) Starting the drills traversing toward the crankshaft and simultaneously initiating the flow of coolant over the drills, (5) Causing each of the drills to drop into feed when the drills are approximately ⅛ in. from the surface from which metal is to be removed, (6) Initiating depth measurement of each drill separately, as the drill contacts the crankshaft, (7) Back traversing each drill separately, when that drill has removed an amount of metal corresponding to the balancing machine measurement, and (8) Unclamping the crankshaft and returning it to a position from which it may be easily returned to the production line.

In this production process, the balancing machine indications are transferred to the drilling machine by means of self-synchronous transmitters and self-synchronous receivers. Attached to each of the six weighing dials on the balancing machine is a self-synchronous transmitter. The rotor of this transmitter is turned with the dial. Each transmitter is electrically connected to a receiver on a drill spindle.

The overall accuracy of the balancing process with the Gisholt two-element equipment on an average automotive crankshaft is 0.2 oz-in.



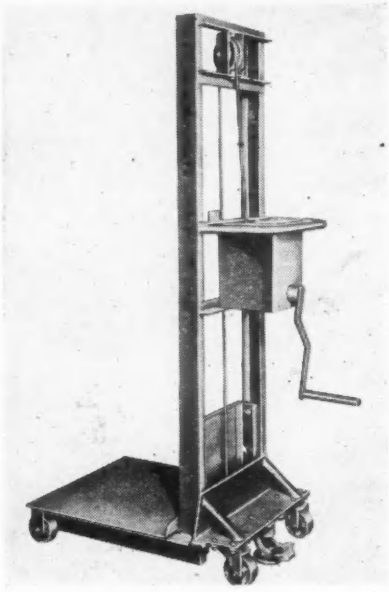
Hydrocast model 3 die casting machine

HYDROPRESS, INC., 570 Lexington Ave., New York 22, N. Y., has just introduced a full line of six sizes of cold chamber die casting machines. These machines having three tie rods are of horizontal design with vertically arranged injection chambers, full-hydraulic, self-contained, semi-automatic and electrically controlled. Since the pouring station is separated from the die, the metal cannot be injected without closing the die. Automatic follow-up of speeds and pressures assures high flexibility of die casting operations to conform to the natural flow of the metal. A double action injection valve for slow injection speed at the beginning, and a booster action, increasing the speed in progress of the injection, insures slow metal filling velocities and high final pressures.

Upon opening of the die the casting is ejected automatically. It is said that no forming of air pockets nor uncontrollable heat losses can occur.

The "Hydrocast" die casting machines are built according to individual requirements either for water hydraulic or for oil-hydraulic operations for working copper, aluminum, magnesium and zinc alloys.

The six "Hydrocast" models range from 10 to 190 tons injection pressure and have casting volumes respectively of 3 cu in. to 300 cu in.



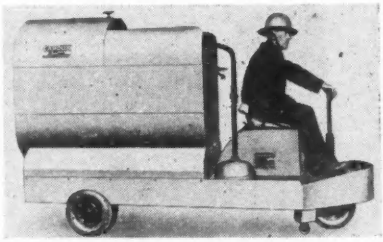
Service Shop Lifter

A LOW-COST entry in the portable elevator field is the new Service Shop Lifter from the Somerville, Mass., plant of Service Caster & Truck Division of Domestic Industries, Inc. The unit is said to be ideal as a die table, lifter and transporter of heavy fixtures, and for tiering boxes. Too, the Service Shop Lifter can be used for raising tote boxes, draining drums, positioning heavy work, installation of machine parts, and for loading and unloading motor trucks.

The lifting platform is cranked up and down, while a specially designed automatic clutch locks the load in any position. Cut steel gears are used in the hoisting unit. Lifting carriage is equipped with sealed ball bearings, while the guide wheels are of heat treated steel. Hand crank, which raises platform three inches with each revolution, is removable.

The Shop Lifter is equipped with four-in. Service ForgeWeld roller bearing casters. Foot operated floor lock is standard equipment. Lock has moulded rubber pad on bottom for floor protection.

ESPECIALLY designed for industries and operations requiring a mobile unit capable if traveling comparatively great distances quickly, the Model 750M Motorized Transitank is now in production at the Cardox Corp., 307 No. Michigan Ave., Chicago 1, Ill. This model combines all the features of the hand-drawn Transitank with the advantage of higher speed in reaching the scene of the fire.



Motorized Transitank

The engine used in the Motorized Transitank is four-cycle, one cylinder, L-head, air-cooled with built-in high-

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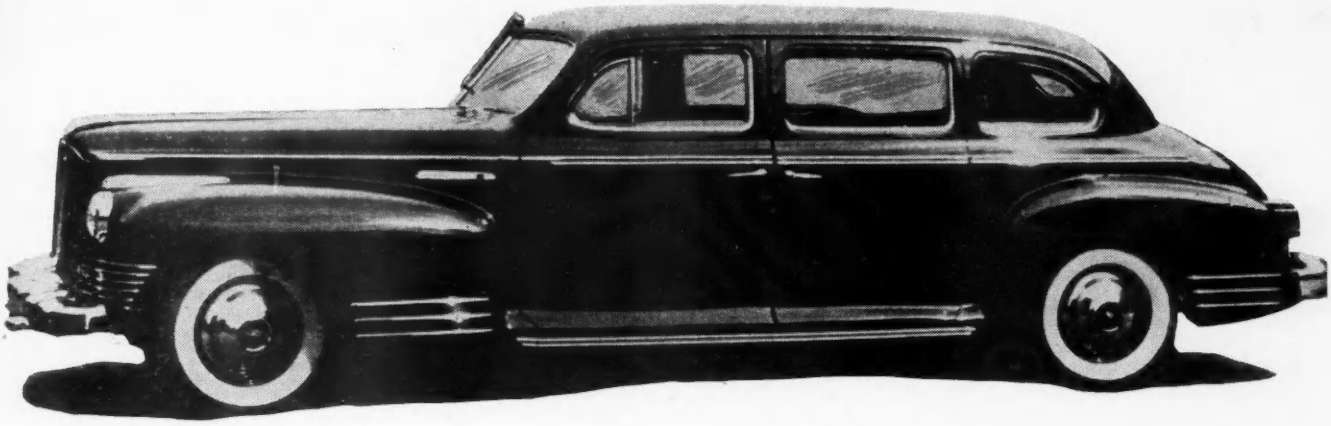
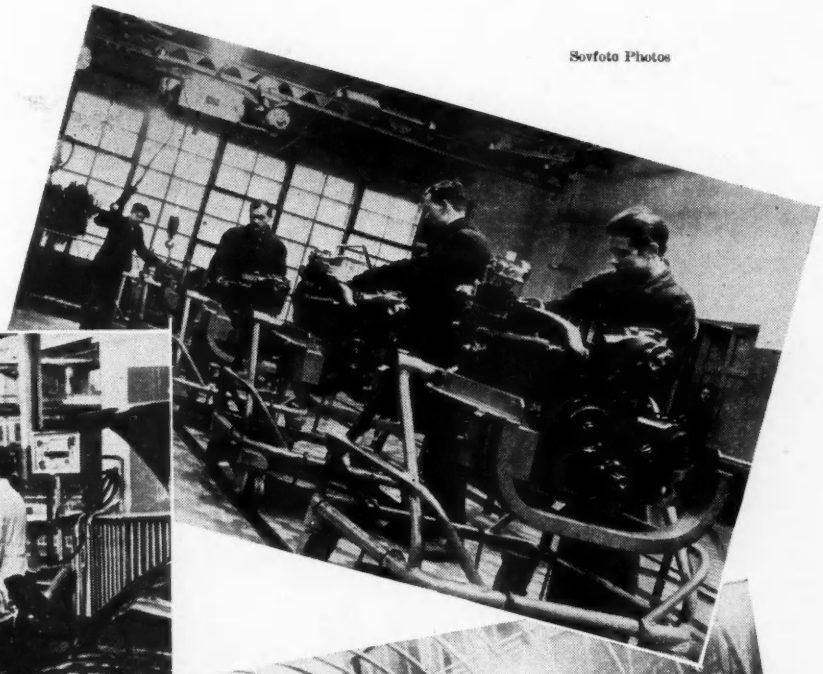
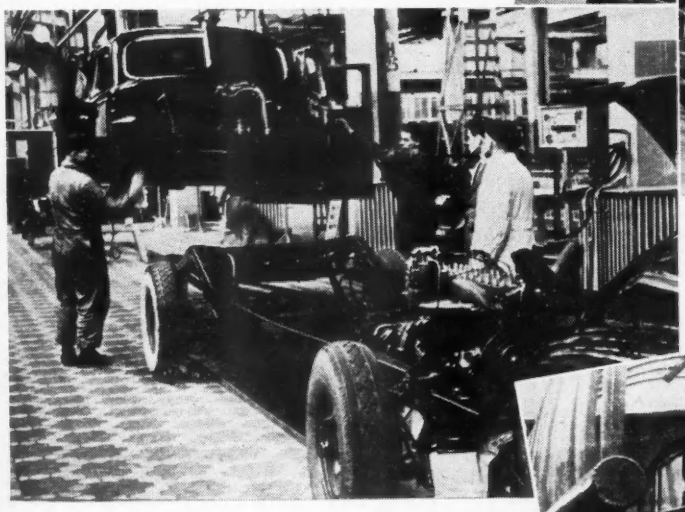


Limousine Production at Stalin Factory

(Above) In July of 1944, while their country was still engaged in war, Russian designers are reported to have begun work on the ZIS-110 seven-passenger limousine model shown in the photo and in early 1946 cars began coming off the assembly line at Stalin plant in Moscow. It is powered by an eight-cylinder 140 hp engine. Two lower powered models are being built at other factories, one the Victory M-20 by the Molotov factory at Gorky.

Sovfoto Photos





(Above) Lowering body on ZIS-110 chassis.

(Right) Engine assembly line at Stalin plant.

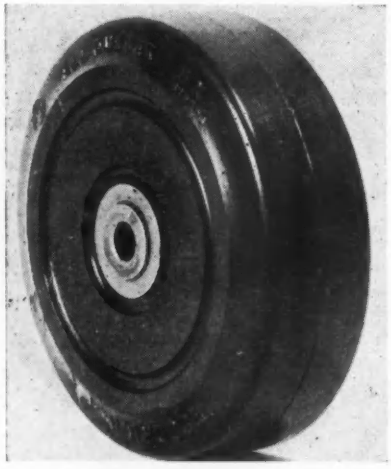
(Lower Right) A ZIS-110 in the "shower room."

All-Rubber Wheel for Industrial Use

An all-rubber industrial wheel is the latest addition to the line of the B. F. Goodrich Co., Akron, Ohio. The new product supplements the company's vulcanized-on tires to metal wheels.

The new wheel is constructed with a metal bearing sleeve molded integrally in a hard rubber core in which ball bearings for a choice of axle diameters are mounted. The company's "low power" E-Z rolling tread rubber compound is vulcanized to the hard rubber core.

Carrying capacity ratings for all-rubber wheels are equal to those for vulcanized-on tires and metal wheels of the same size, but resistance to extreme impact loads is less because hard rubber shatters more steadily than cast iron. They are, therefore, not recommended where extremely rough usage is encountered.



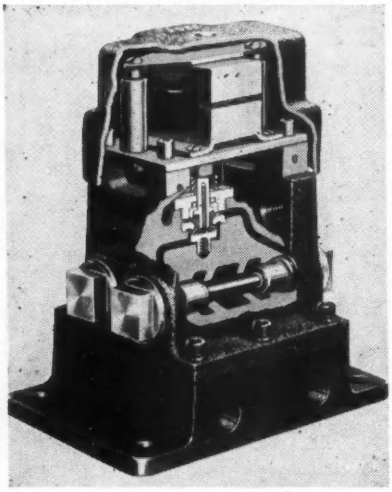
Goodrich industrial wheel

In services where agents corrosive to metal wheels or detrimental to the rubber-to-metal bond cause early failure of rubber tires vulcanized-on to metal wheels, the new all-rubber wheel is especially recommended by the manufacturer.

Solenoid-Controlled, Pilot-Operated Air Valve

A new valve has just been brought out by the Ross Operating Valve Co., 6481 Epworth Blvd., Detroit 10, Mich. It is the Ross piston poppet, pilot-operated, solenoid-controlled air valve. The valve is comparatively small and compact and allows operating speeds up to 400 cycles per minute, with current consumption 1.2 amp. at 110 volts 60 cycles.

All working mechanisms are interchangeable—removing the two end plugs allows for replacement of piston poppet assembly. There is no need to remove piping or to remove valve from



Ross valve

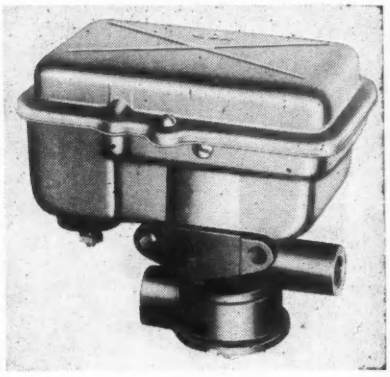
position. This model is available in three-way (normally open or normally closed), four-way, and four-way (5 port) and in ¼ in., ⅜ in., ½ in. and ¾ in. sizes.

Electric Fuel Pump

A new electric fuel pump suitable for use on passenger cars as either standard equipment or as an accessory as well as for use on trucks and buses has been developed by the Instrument Division of Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14, Ill. Designated Model 110-N, the new pump supersedes and out-performs the Stewart-Warner pre-war Model 110-D and is the first electric pump made by Stewart-Warner readily adaptable to passenger car installation as well as for use on trucks and buses.

Advantages claimed for the new Model 110-N pump by Stewart-Warner are: It can be serviced in the field without special tools; it has a delivery capacity up to 15 gal. per hour, instead of the 13 gal. of the previous model; in operation, it is entirely independent of, and can be mounted remote from, the vehicle's engine.

An improved, vibration-proof, enclosed and sealed magnetic switch, hydrogen filled to prevent burning of contact points, elimination of timers and resistors and their replacement with a

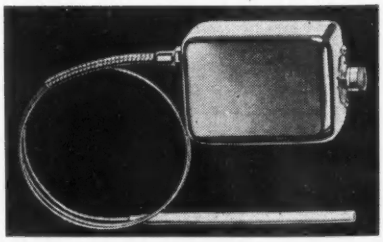


Stewart-Warner electric fuel pump

simple, open-blade "trigger" switch in which arcing is minimized by use of a field coil to absorb inductive surge at the moment of contact break, and new, non-critical positioning of the switch on a bracket, ready for use and requiring no special adjustment or subsequent readjustment during service, are other desirable features or improvements claimed by the manufacturer.

Remote-Bulb Type Control

United Electric Controls Co., A and Athens St., Boston 27, Mass., offers to the trade a low-cost control of the remote-bulb type. Known as the Type O thermostat, it is especially designed for industrial applications requiring accurate control of temperatures over narrow calibrated ranges. The new Type O can be used for all liquids or gases non-injurious to brass, or for metal to



Type O thermostat

metal applications, and can be equipped with ambient temperature compensation. Thermal assemblies can be plated or supplied in stainless steel for applications injurious to brass. Control is based on a snap-action switch actuated by a liquid-filled copper thermal assembly. This assembly has an unvarying and rapid expansion and contraction per degree of temperature change, and can be adjusted by either a knob and pointer with calibrated dial, or by a screw driver. The calibrated adjust-

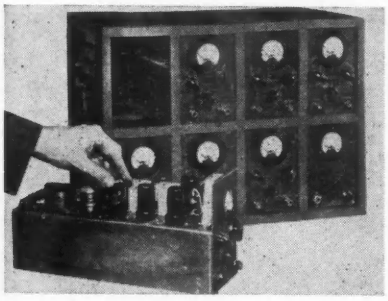
New Products

ments cover any 120 or 250 F in the range from —120 F to 600 F, and screw driver adjustments cover entire ranges from —120 F to 180 F, from 50 F to 350 F, or from 50 F to 600 F.

Four bulb types, designed to provide most efficient operation for the particular installation, are available for use with the new Type O.

Strain-Gage Amplifier

A strain-gage amplifiers designed for use with resistance-wire, electro-magnetic and magnetostrictive strain gages for amplifying small electric signals varying in frequencies from 0 to 1000 cycles per second has been added to the line of General Electric strain-gage



G.E. strain-gage amplifier

equipment. The new amplifier is operated in conjunction with either a magnetic oscillograph or a cathode ray oscilloscope. Small and light in weight, it is suitable for aircraft flight-testing applications when test equipment must be taken aboard a plane, as well as for use in development and testing laboratoreis and production shops.

Available for use on 115-volts, 60-cycle a-c or for battery operation at 24 volts, the strain-gage amplifier consists of a 5000-cycle oscillator unit, a power unit, and either two or six identical amplifier units, all mounted in separate chassis in a case. The amplifier channels are stabilized against line voltage change or variations in tube characteristics, and each can be removed for servicing and inspection.

The instrument and operating controls for each amplifier channel are mounted on the front panel, and include controls providing impedance balance and phase balance for the gages, and instruments showing the output in milliamperes of each channel. Connectors are provided at the back of the unit for connection to the gages and to the indicating or recording instrument.

Heavy-Duty Detergent

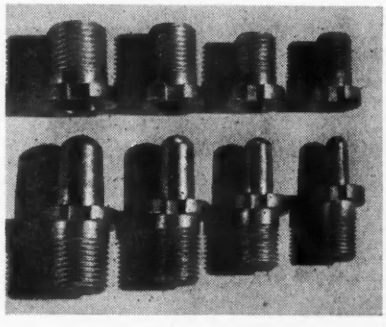
A new heavy-duty alkaline-type detergent specially designed to use in modern steam guns and coil-type steam generating mechanisms has been announced by Oakite Products, Inc., 28-A Thames St., New York 6, N. Y.

The new high-speed detergent, called Oakite Composition No. 92, has been pretested during the past year. Reductions in time and cost allocations for such jobs as the following are said to have been recorded; cleaning machinery and equipment parts for subsequent repair and overhaul, preparing equipment surfaces for repainting or refinishing, cleaning equipment too large for tank immersion or where suitable tanks are not available, paint stripping and other cleaning operations.

The new Oakite detergent is described as giving thorough and fast steam-cleaning action at very low concentrations. Specialized advantages associated with the product by the manufacturer include: prevention of scale clogs in steam coils, ready dissolution in hot water, free-rinsing action on all surfaces, safe and pleasant handling without offensive fumes or toxic vapors.

New Metal Dowel Development

An improved type of metal dowel for metal patterns and core boxes is now available from the Kindt-Collins Co., 12651 Elmwood Ave., Cleveland 11, Ohio. Known as the Master Sure-Lock dowel, it is available in the following sizes: Nos. 1, 2, 3 and 4 standard; Nos. 2 and 3 special with extra long pin and body on male part. These long-bodied pins can be fitted with nuts for permanent installation. Nos. 2 and 3 special can be inserted with Nos. 2 and 3 standard wrench.

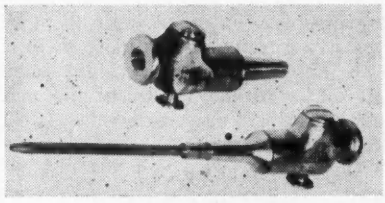


Master Sure-Lock dowels

The dowels are accurately machined from steel, hardened and cadmium-plated to prevent rust. A new type wrench of hardened steel permits firm tightening of dowels.

Improved Air Gun

An improved air gun, the "Guardair," has been designed by Algonquin Parts, Inc., 5000 Connecticut Ave., So. Norwalk, Conn. An airguard, located above the nozzle of the air gun, provides a safety umbrella of air. Particles ejected by the nozzle are removed from the work by a feather-action thumb button. Instead of chips, metal powder, sawdust, oil or other materials ricocheting into the operator's eyes, these minute particles are arrested by the invisible ring of air and plummeted downward.



Guardair air gun

Guardair is available with both standard nozzle as well as with extended tip for deep hole drilling operations, etc. It is available in all standard as well as special thread sizes to fit any hose coupling.

Direct-Reading Taper Gages

Direct-reading leaf taper gages, which are said to provide a solution to the problem of measuring the exact size of trial cuts in bringing a hole up to size during boring or grinding, have been introduced by Moore Special Tool Co., Inc., Bridgeport, Conn.

Thirty-six individual leaf gages, graduated in thousandths of an inch, enable the operator to keep track of stock removal as he goes along. Hole sizes in infinite increments from .095 in. to 1.005 in. can be read directly from the gage without reference to another standard.

Each leaf is a separate tool, accurate to .00025 in., and may be used individually without interference from any other leaf in the set. The graduations on each size overlap the next by

Moore taper gages

.010 in. to facilitate measuring of counterbored or shoulder holes.

Short enough to permit their insertion into a hole between the withdrawn cutting tool or grinding wheel, without moving the work, Moore leaf taper gages may also be used to measure the bottoms of through holes to check for bellmouth or taper. The diametral two-point contact also facilitates checking holes for out-of-roundness. The leaves are arranged to enable measuring of any holes in fractional increments of 1/16 in. (1/32 in. in most cases), if holes are at least 9/16 in. deep.

Battery with Oversize Electrical Capacity

An improved automotive battery with oversize electrical capacity, but adaptable to conventional-size battery cradles, is now in production at The Electric Auto-Lite Co., Toledo 1, Ohio.

The newly developed battery is said to have a capacity for three times as much water, when water is needed, as is contained in the ordinary battery. This additional water space means that the battery need be watered only one-third as often as the conventional battery.

The battery is built in a hard rubber container and utilizes fibre-glass insulation which prevents loss of power-producing active material from the plates.

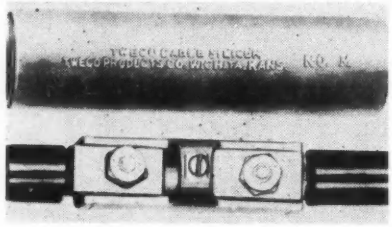
Wear-Resisting Micrometer

The Sapphire Products Division of the Elgin National Watch Co., Elgin, Ill., has placed on the market this outside micrometer tipped with sapphire. This micrometer is available in one-in. to six-in. sizes; English and Metric styles. Specific features are: Adjustable spindle bushing; hollow, lightweight frame; stabilized steel throughout; tool steel ground spindle thread; positive lock nut; and 0.0001-in. graduations

Splicers Provide Repair for Broken Welding Cables

A complete new line of welding cable splicers has just been completed by the Tweco Products Co., Wichita 1, Kan.

Tweco cable splicers provide a quick repair of broken cables or salvaging short lengths. A clamp cable connection on each end of the splicer, with provision to solder between the cable ends, is said to assure an efficient connection. A fibre sleeve covers this easily-installed cable splicer.



Tweco welding cable splicer

The splicers are made in three sizes to cover the full range of welding cables. Size "S" for small No. 4, 2, or 1 cables; size "M" for medium No. 1/0 or 2/0 cables; size "L" for large 3/0 and 4/0 cables.

Silicone Resin for Heat-Resistant Paints

Preliminary data has recently been released concerning a new thermosetting silicone resin developed by Dow Corning Corp. for use in formulating exceptionally heat and moisture resistant paints having a hard, mar-resistant surface. This new resin known as DC 804, is especially indicated for use in formulating white finishes having properties between those of ceramic coatings and ordinary organic paints.

Such finishes formulated with DC 804 do not become yellow or chalky with age because of the exceptional resistance of this silicone resin to moisture, oxidation, ozone and ultra-violet radiation, according to the manufacturer.

Two New Metal Cleaners Produced by Pennsalt

Two new products, Pennsalt Cleaner A-22 for aluminum alloys and PM-95, an acid base cleaning and descaling compound, have been formulated by the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.

Pennsalt Cleaner A-22 is a general purpose soak tank cleaner for use on all aluminum alloys. Most common applications are cleaning aluminum before anodizing, chromodizing, phosphatizing and other pre-painting treatment, and before deoxidizing and subsequent spot welding.

Pennsalt PM-95 is a specially prepared cleaning and descaling compound containing additional agents for surface action and inhibition. Suggested uses are general pickling and metal descaling, especially for difficult-to-remove oxides resulting from heat treating or annealing.

Protective Coating for Spray Booth Side Walls

Detrex Corp., 13001 Hillview Ave., Detroit 3, Mich., has brought out a new product—Triad PR—a protective coating for spray booth side walls.

Triad PR, readily applied to the side walls of either wet or dry spray booths with brush or spray gun, provides a light-reflective finish that withstands mild abrasion. This white brilliant surface improves visibility in the booth and is easily flushed off with water or steam carrying all surface deposits with it.

PR aids in the speedy stripping of

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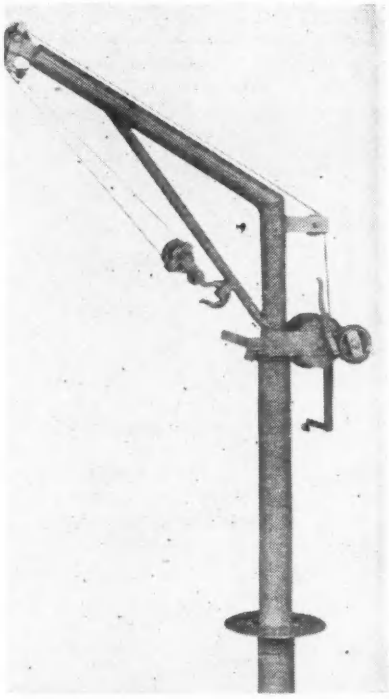
Removable Truck Cranes



Blue Heron cranes, distributed by Cam Tool Co., 288 21 St., Oakland, Cal., mount in a well or socket which is permanently attached to the truck frame, but the crane itself can be removed in a few minutes, leaving the truck bed clear. These cranes swivel through an entire circle but may be held at any point by a locking device. There is also a locking pawl on the hoist winch. Cables are plow steel, gears are cut steel, and an air winch can be supplied at extra cost. All Blue Heron cranes are said to have a generous safety factor. They may be used for handling heavy automotive parts, such as engines and truck transmissions, oil drums, castings and other heavy parts and materials

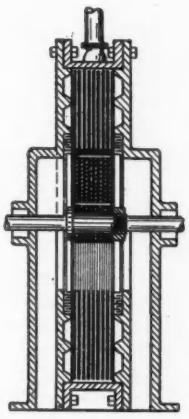
Going to Tesla for a Turbo Supercharger

Editor of AUTOMOTIVE *and* AVIATION INDUSTRIES,

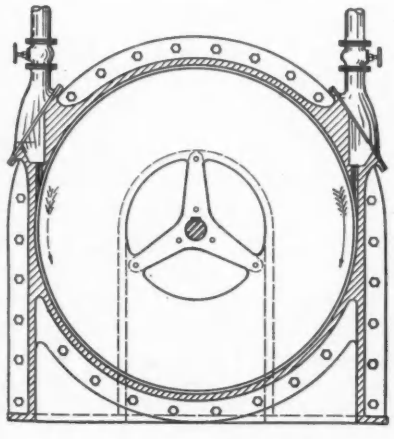
Exhaust turbo-superchargers for airplane motors have now reached very good efficiencies, but cost is still prohibitive for most civilian purposes. Nor can any improvement in engineering ever make axial turbines and compressors really cheap. If cost is ever to be radically lowered, design must be radically changed.

One such radical design was patented by Tesla back in 1913 (No. 1,061,206)—far the simplest turbine and compressor ever conceived. It consisted of steel discs about 0.03 in. thick spaced about 0.03 in. apart on a shaft, steam entering tangentially from the periphery and leaving from the center. Efficiency was greatest when the peripheral speed of the discs was nearly equal to the velocity of the steam; power was greatest when the speed of the discs was one-half the velocity of the steam. An early model has eight discs 5 in. in diameter weighing less than 10 lb. developed 30 hp.—more than 3 hp. per lb.

The 35,000 r.p.m., however, was too high for most power purposes. Allis Chalmers, experimenting with discs 60 in. in diameter and 0.125 in. thick, found that they warped badly and would soon have failed. But we now have much better steels than 25 years ago, as well as far more knowledge about normalizing steel. So it should now be possible to construct a Tesla turbine which would stand up under continued service. And though Allis Chalmers found that its experimental model was more expensive than one of a conventional type, all the machining of Tesla's turbine is so simple that quantity production should greatly reduce its cost. The extremely high r.p.m., moreover, which is a disadvantage for most other purposes, would be only an advantage in supercharging internal combustion engines; while its peripheral speed is so high that back pressure of the exhaust gases should be much less than in exhaust turbines hitherto tried.



Vertical cross section of Tesla turbine



Partial end view of Tesla turbine

There is another feature which to a layman would seem attractive. It is well known that when the exhaust valve or port first opens the burnt gases leave the cylinder at sonic speeds —i.e., at the speed of sound in gases of their temperature, or some 4,000 ft. per sec. After the initial exhaust there may be a partial vacuum in the cylinder, followed by the return of some burnt gases to the cylinder. Now the discs of a Tesla turbine might conceivably have a peripheral speed of half the sonic speed of the exhaust gases, i.e., their difference in speed from the exhaust gases might be that which Tesla claimed would develop the most power. Discs 12 in. in diameter and having a peripheral speed of 2,000 ft. per sec. would be rotating 38,197 r.p.m. This does not seem altogether beyond reach. Thus a Tesla turbine might utilize not merely the ordinary pressure of the exhaust gases but even their sonic speeds and thereby achieve higher efficiency than would otherwise be possible. At the very least, the rapidly rotating discs should act as a one-way valve and prevent the return of any of the exhaust gases to the cylinder.

Tesla claimed that this turbine could also be used as a compressor, in which case the discs should be increased in number and spaced more closely together. I have heard of no experimentation with such a compressor. But if its efficiency could be made reasonably good, its combination with a Tesla turbine on the very same shaft would be truly beautiful.

Thus a Tesla turbo-supercharger would seem to have many most attractive features—extreme simplicity, eventual cheapness of manufacture, possibly high efficiency, very little—perhaps even negative—back pressure on the engine cylinders, and an unrivalled power-weight ratio. If no commercial material could stand such high r.p.m.'s at the high exhaust temperatures of airplane motors, there should still be a place for charging two-stroke Diesel engines, whose exhaust temperatures are more moderate. Where the efficiency of an engine is more important than its weight, exhaust temperatures could be brought within the necessary limit by expanding the gases in the cylinder above their initial volume. Or the exhaust gases could be cooled as much as was necessary by generating steam, which would go to its own separate turbine on the same single shaft.

Here is a field which has so far been quite neglected, but which certainly seems worth cultivating.

LOCKWOOD MYRICK.

Descartes 52

(*Continued from page* 39)

lons capacity, two spare wheels, a tool compartment and rather more than 10 cubic feet of baggage space. A radio set specially designed for this car is built into the instrument board.

Performance figures are more than 90 miles an hour and, by reason of the low weight, scientific streamlining and highly efficient engine a gasoline consumption of 18 miles to the American gallon at an average speed of 60 miles an hour.

Light alloys are used almost exclusively for all but working parts (crankshaft, camshafts, gears, etc.). About 25 per cent of the alloys are castings and 75 per cent consist of sheet aluminum. The one-piece chassis-body is built of sheet Duralinox, 60 per cent of these being hand beaten panels and 40 per cent pressings.

Jack & Heintz Engine

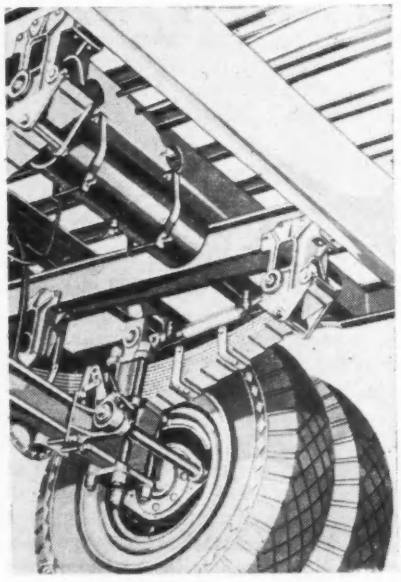
(*Continued from page* 20)

cooler and into the storage tank. A very small bleed hole on the discharge side of the pressure pump permits some of the oil to flow through the fine by-pass filter and return to the sump. In the wet sump system a full-flow filter is installed after the pressure pump before the oil gets to the bearings.

New Spring Developed for Fruehauf Trailer Line

Fruehauf Trailer Co., Detroit, Mich., has added to its line of commercial trailers the Aerovan trailers equipped with either aluminum or stainless steel bodies, and the deluxe model "Livestock Limousince." The entire line of bodies may be mounted on either of the two new Fruehauf suspension systems—the gravity torsion bar tandem axle (see AUTOMOTIVE & AVIATION INDUSTRIES, Jan. 15) or the new "multi-rate" spring suspension single axle system.

The Model 5 multi-rate spring suspension embodies a new design in which the spring rate is said to increase in proportion to the load, from empty to overload. The Model 5 axle has a carrying capacity of 20,000 lb. Design of this suspension (see illustration) is on the order of the so-called slip-end principle, using a long spring of maximum flexibility riding on rollers in each spring hanger which are effective only under no-load conditions. The entire weight of the vehicle, when unloaded, rests on the extreme ends of the top leaf.



Underside view of the new Model 5 Multi-rate spring suspension.

The radius rod is hinged on the spring hanger at the front end and is tied to the axle, independently of the spring, by means of the interlocking bracket. In addition to removing all strain from the spring center bolt, this construction uses straight bolts rather than U-bolts to tie the assembly together, thus eliminating the stretch said to be common in many U-bolt fastenings. The radius rod is so arranged as to take a down position when the vehicle is light, and an up position when overloaded. Under normal loading the radius rod is horizontal, permitting the least possible movement, forward or backward, allowing equal spring movement front and rear.

New British Trainer

The Percival Co. announces a new primary trainer similar to the Proctor in appearance. Designated the T/23/43, it carries a crew of three, two students and an instructor. The instructor and one student are seated side by side with dual controls, while the second student is seated immediately behind them on the center line of the aircraft. No controls are fitted at this latter station, but both students are able to listen to the instructor by means of electric inter-communication. The pneumatic wheel brakes are controllable from each stick. An over-ride control is fixed to the instructor's stick so that the students brake lever can be made inoperative. This new Percival trainer is designed to take either the de Havilland Gipsy Queen 31 or 51 engine. Both types are fitted with a constant speed propeller. Specifications for the T/23/43 Britsh Trainer are:

Engine, Gipsy Queen	Series 31	Series 51 (supercharged)
Take-off power rating	250 hp	295 hp
Gross weight	3775 lb	3850 lb
Maximum speed at sea level	155 mph	
at 6800 ft altitude..		171 mph
Cruising speed, at 3500 ft	143 mph	
at sea level		129 mph
at 12,200 ft altitude		154 mph
Stalling speed, crew of three, flaps up ..	61.8 mph	62.4 mph
flaps down	50.5 mph	51 mph
Rate of climb at sea level	890 fpm	1070 fpm
Service ceiling, approximately	18,000 ft	19,000 ft
Range, at 136 mph, sea level	464 miles	
at 129 mph, sea level		505 miles
at 141 mph, 5000 ft..	495 miles	
at 139 mph, 5000 ft..		517 miles

Solex Bicycle Engine

Solex Bicycle Engine

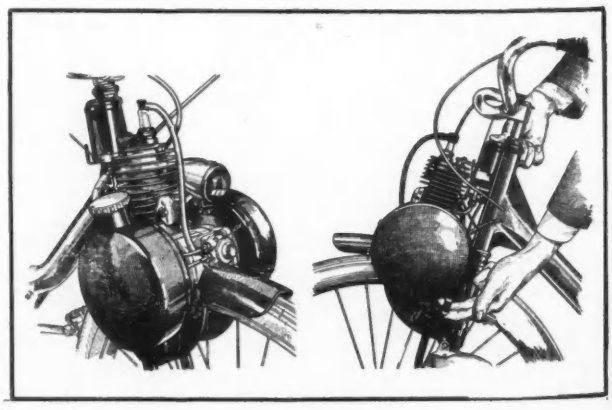
By W. F. Bradley
Special Correspondent. Automotive and Aviation Industries

SOLEX, Europe's leading carbureter manufacturer, has taken over one of the Hispano-Suiza factories in the suburbs of Paris and has equipped it for the production of a motorized bicycle. Weighing 51 pounds complete, the bicycle has a special reinforced drop frame and is propelled by a single cylinder two-stroke engine of 45 cc. by means of a friction wheel to the front tire. The engine is pivotted, allowing it to be disengaged by merely pulling it rearwards.

A feature of the engine is that gasoline is fed to the main jet by means of a small pump, with overflow to the tank. There is no float chamber, float or needle valve. On the right hand side of the power plant is a gasoline tank, and on the opposite side, and of exactly the same dimensions, a magnetic flywheel supplying current for ignition and lighting. Lubrication is by oil mixed with the gasoline. There are no external points of lubrication. The engine is dead silent.

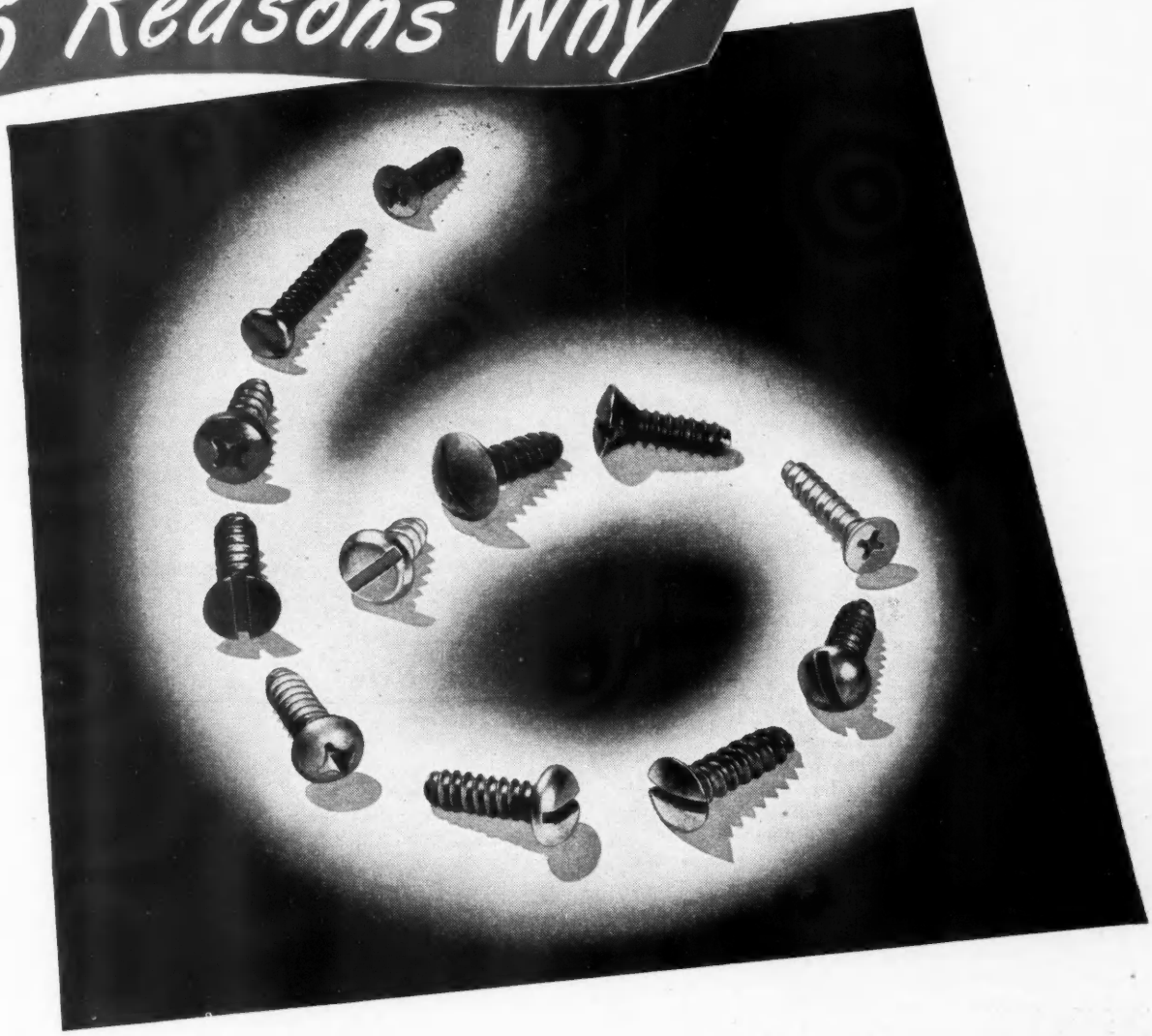
Road speed is 6 1/5 mph at 1000 revolutions, with a maximum of 17 miles. Developing two-fifths of a horsepower at 2000 rpm, the engine is sufficient for ordinary hills, but calls for pedalling on steep gradients.

With a phenomenal rise in the use of bicycles under post war conditions, it is felt that there will be a big demand in Europe for a power driven machine retaining all the advantages of the push bike.



Right and left sides of the Solex engine.

6 Reasons Why



Hardened sheet metal or tapping screws by "NATIONAL" are "TOPS"

1. Materials are carefully selected and tested.

2. Case hardening is expertly controlled to assure strength without brittleness.

3. Threads are sharp, smooth and hard, accurately dimensioned for driving and holding power. All screws are threaded to the head.

4. Heads are concentric, free from burrs, and with true seating surface on all types.

5. Slot or Phillips Recess is correctly formed and well-centered, and dimensioned for ample driving torque.

6. Points are properly shaped—equally important on both gimlet and blunt point styles.

"National" Hardened Sheet Metal or Tapping Screws, Types A and B (formerly known as Type Z), are furnished in regular stock sizes: Round Head, Binding Head, Stove or Low Round Head, Oval and Flat Head.

We will gladly furnish information on types and sizes of screws to be used with various metals and metal thicknesses and for specific applications.

National
HEADED AND THREADED PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

NEWS *of the* Industry

Production Outlook Brighter . . . Spring Wire Still Scarce . . . Output Far Below Schedule for First Six Months of 1946 . . . Limited Availability of Steel May Continue for Several Years . . . Car Maker's Losses at All-Time High Rate During First Three Months of this Year . . . Ford Sees Loss to Manufacturers at Present Prices.

For the first time in many weeks a faint streak of optimism is showing through the heretofore dense cloudbank of gloom hanging over the automobile industry. Production men who have been looking at projected schedules with long faces have brightened just a bit over prospects of stepping up output somewhat during July. After weeks of intermittent up-and-down production, it now looks to them as if perhaps the labor situation will quiet down a bit and as a result supplies will move into the plants in somewhat heavier volume than has been the case during past months.

There have been indications that the number of supplier strikes, which were at a peak during May and June, is dwindling at an encouraging rate. At last reports, the number of General Motors suppliers having strike trouble had dropped to a few more than a hundred, whereas three weeks previously it had stood at nearly 150. Likewise, Ford has seen the number drop from a high of 52 at one time during May to something under 25. The labor situation in the major supplier industries, such as coal and steel, appear to be settled for the time being at least, and with the heartening trend toward settlement of smaller supplier difficulties, the air now is more clear than at any time for the past three months. Before anyone starts to talk about peak production, however, it should be remembered that output is not going to hit anything like prewar volume for some months yet. The situation is not that good—it only is somewhat better than it has been.

Spring Wire Supply Not Yet Adequate

One of the major items holding back production in many companies has been the shortage of steel spring wire for seat and back cushions. Lack of this critical item has been keeping some companies on only part-time schedules, but the prospects for improvement now appear to be favorable, and it is expected that by the end of July the supply will be equal to the limited production allowed by other factors.

Production Off Schedule by 1,680,000 Cars Since Jan. 1

Passenger car production was 1,680,000 below schedule in the first six months of 1946. An estimated $1,500,000,000 in sales have been lost with further losses anticipated, according to George W. Romney, general manager, Automobile Manufacturers Association.

Production schedules for 1946 reported by the individual companies to the War Production Board in 1945, called for assembly and delivery to dealers of 2,320,000 cars by the end of June. Actual deliveries totaled only 654,000, more than 1,680,000 cars below schedule.

A rising curve of production starting in the closing months of 1945 had been expected with new cars being assembled at a monthly rate of 500,000 by midyear. Actual production fell far below this figure with only 140,000 cars assembled in June.

Production for the first six months was as follows: January, 59,000; February, 48,000; March, 90,000; April, 150,000; May, 152,000; June, 140,000.

Contributing factors to the low production curve were: Strikes in vehicle manufacturing plants; suppliers' strikes; shortages of materials directly or indirectly caused by restrictive government policies; drop in labor productivity; and the effects of the coal and steel strikes.

Despite More Favorable Outlook Production This Year to be Short

Admitting that conditions have improved, it still is obvious that production in 1946 is not going to set any kind of record. Output the first half of this year was something less than 1 million cars and trucks, and production will have to double if three million cars are to be built this year, a sorry total in view of the optimistic predictions of early 1946. Another disturbing factor militating against high production, not only this year but in 1947 and possibly 1948 as well, is the limited availability of steel. Three of the larger companies have made separate surveys of the situation and have come up with some glum predictions. Ford estimates that steel will be available for a maximum industry-wide production of from 4.75 to 4.8 million units in 1947 and 6 million in 1948. Another company predicts that the annual production rate cannot exceed 5 million cars and trucks until mid-1947, whereas the third company says the other two are too high in their estimates and that the sheet steel supply will permit a maximum production in 1947 of from only 4.25 to 4.5 million units. These estimates are predicated on the assumption that there will be no further tieups in the steel industry and that the automotive industry will get its historical share of production.

Automobile Companies' Losses Run High in First Quarter of '46

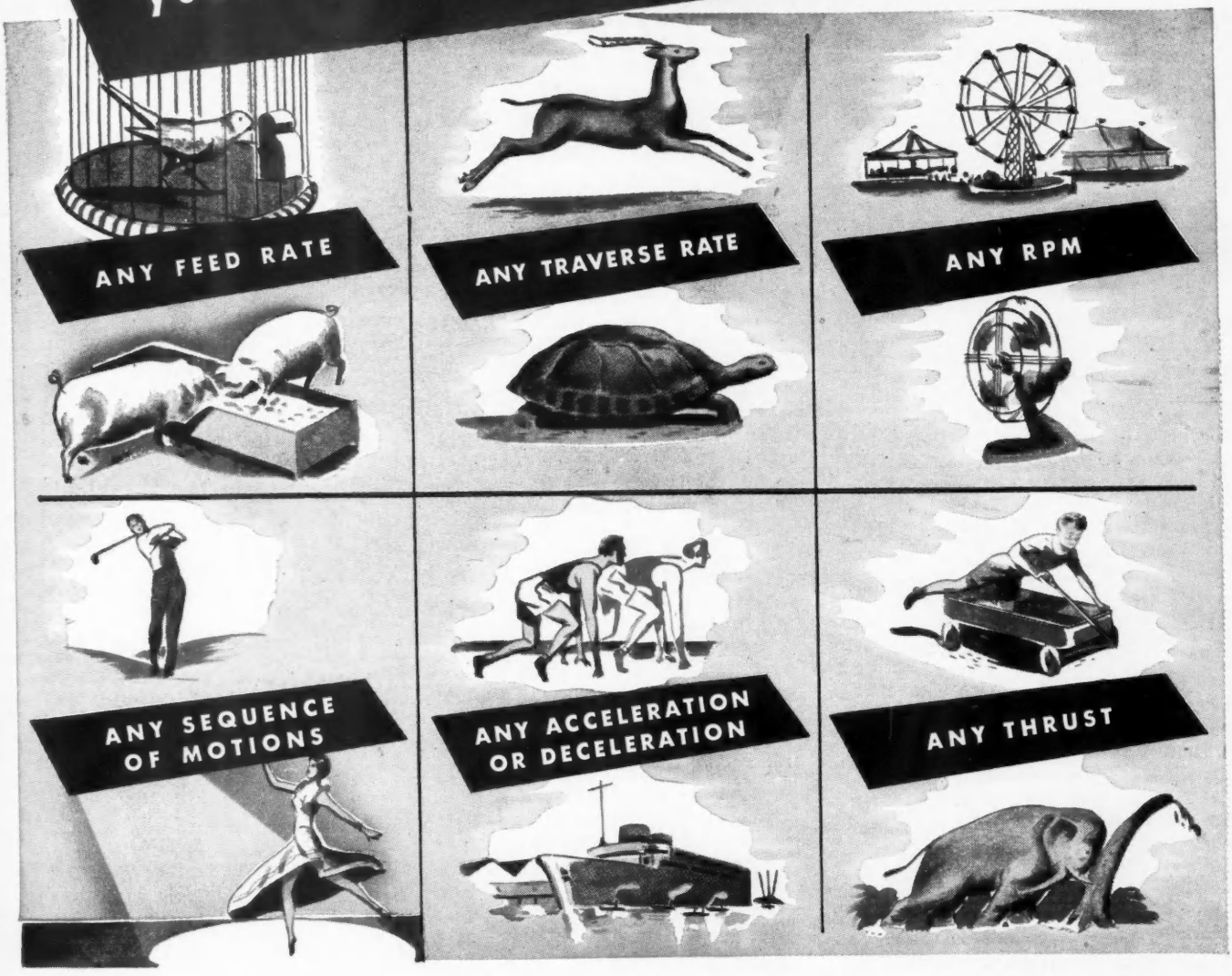
Labor leaders who last Fall were peddling political flapdoodle about basing wages on ability to pay and sounding off in general on profit-bloated corporations might well examine the profit and loss statements of the car makers for the first quarter of this year. They might well ask themselves what wages now would be if based on profits or what position the companies would be in to pay wages at all if they had not built up a profit reserve to meet payrolls in the present era of low production and high operating losses. A report compiled by AMA shows that passenger car manufacturers sustained a net loss of more than $50 million, or more than 10 per cent on every dollar of sales during the first quarter. If tax carry back provisions had not been in effect, the net loss would have been staggering. And the prospects for any better showing in the second quarter are extremely dubious. The 10 per cent loss of every dollar of sales is the heaviest in the history of the industry, even topping that of the depression year of 1932 when it was 6.7 per cent of dollar sales.

Ford Sees No Break-Even At Present Price Levels

The general assumption prevailing in Washington and throughout the country generally is that high volume production will enable the automobile man-

(*Turn to page* 60, *please*)

VERSATILITY that *Exactly* meets your needs in MACHINE TOOLS



Machine tool design is set free from a host of limitations when Vickers Hydraulic Controls and Drives are used. With no difficulty at all, the designer has an extremely wide choice of feed rates, traverse rates, RPM, sequence of motions, accelerations or decelerations, and thrusts.

Practically any machine tool can be designed *and built* to do *exactly* the required job by using Vickers Hydromotive Controls in one of the infinite number of combinations provided by more than 5000 standard Vickers Units.

In addition, positive overload limitations can be built into any machine—definite safety factors provided for both the machine and the operator.

Only Vickers Hydraulic Controls provide *all* the advantages of hydraulic operation—including exceptional compactness and reliability.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

General Motors Corp., Buick Motor Div.—**Paul E. McCracken,** General Parts and Accessory Manager; **C. W. Jacobs,** General Service Manager.

Pontiac Motor Div.—**L. W. Ward,** Asst. Sales Manager, in charge of Western U. S.

Ford Motor Co.—**Mel B. Lindquist,** Asst. Director of Industrial Relations.

Chrysler Export Corp.—**K. H. Kingsley,** Asst. to **L. H. Perry,** General Works Mgr.

Kaiser-Frazer Corp. and Graham-Paige Motors Corp.—**Dr. Clifford H. Keene,** Medical Director.

Nash Motors Div.—**Walter K. Sittman,** Technical Adviser to the Advertising Dept. **James Molloy,** Parts and Accessory Merchandising Manager.

Willys-Overland Motors, Inc.—**Arthur J. Wieland,** elected vice-pres. in charge of distribution.

Mack Trucks, Inc.—**Howard C. Glunz,** Manager, Toronto Branch.

Curtiss-Wright Corp., Propeller Div. —**William C. Schulte,** Quality Manager.

Douglas Aircraft Co.—**Patsy Kelly,** resigned as chief technical librarian.

Consolidated Vultee Aircraft Corp., Stinson Div.—**James L. Green,** Regional Sales Mgr. for Eastern United States. **R. D. Macdonald,** appointed Staff Asst. to Larry Cooper, General Sales Mgr.

Westinghouse Electric Corp., B. F. Sturtevant Co. Div.—**Harold C. Hickock,** Central District Manager, with headquarters in Pittsburgh.

Houdry Process Corp., **Dr. Claude Peavy,** Manager of Process Design Div.

United States Rubber Co.—**Dr. Sidney M. Cadwell,** Director of Research and Technical Development.

Casco Products Corp.—**Joseph H. Cone,** re-elected President; **B. G. Cochrane,** Vice-Pres. and Sales Mgr.; **A. O. Samuels,** Vice-Pres. and General Mgr.; **E. T. McCarthy,** Vice-Pres. and Controller; **E. F. Klein,** Treas.; **Jack Schenberg,** Secretary; **S. Cone,** Asst. Treas.; **L. E. Fenn,** Asst. Sec. and Asst. Treas.

Pennsylvania Salt Mfg. Co.—**Walker Penfield,** Manager of Manufacturing.

Aluminum Industries, Inc., Industrial Div.—**Howard S. Brown,** Sales Engineer, Chicago.

Chicago Pneumatic Tool Co.—**W. Luther Lewis,** elected President, succeeding **H. A. Jackson,** Chairman of the Board of Directors.

The Baldwin Locomotive Works—**R. Nevin Watt,** General Manager of Sales.

Briggs Mfg. Co.—**Stanley W. Cochrane,** Director of Purchasing.

Bearings Company of America—**H. W. Jackson,** resigned as President and Director of the company.

Irving Air Chute Co.—**William H. Schwinger,** Vice-Pres. and Treas. and Gen. Mgr. of Operations, United States and Canada. **Harold G. Rogers,** Vice-Pres. in chg. of Sales. **F. Leslie Marsden,** Pres. of the Buffalo Aeronautical Corp., has been elected a director of Irving Air Chute Co.

The Glidden Co., Paint Div.—**Charles M. Dunn, Jr.,** Manager of Aviation Sales and **James C. Rankin,** Asst. to J. L. Noon, Mgr. of Industrial and Transportation Sales.

Joseph T. Ryerson & Son, Inc.—**Ernest L. Hartig,** retired as Vice-Pres. and Treas. **Merle A. Miller,** elected Treasurer; **Frank H. Ziebell, Jr.,** elected Controller, a newly created office. **Thomas G. Miller,** elected Asst. Secretary; **George W. Geiger,** elected Asst. Controller.

Cleveland Punch & Shear Works Co. —**Mrs. Florence M. Sayle,** elected President, succeeding her late husband, W. Chichester Sayle.

Heller Bros.—**Lloyd C. Smith,** Vice-Pres. and General Mgr.

The B. F. Goodrich Co., **Dr. Rex H. Wilson,** appointed medical director.

Metal Specialty Co.—**Marvin W. Maschke,** elected to Board of Directors. He is Chief Engineer of the company.

Lear, Inc.—**Niels Eklund,** Chief Physicist.

R. M. Hollingshead Corp., Aviation Products Div.—**Frederick H. Lee, Jr.,** Sales Mgr.

Brooks and Perkins.—**Clifford W. Sponsel,** General Manager.

Hydropress, Inc.—**Dr. R. M. Reichl,** Vice-President.

Eclipse Counterbore Co.—**Frank C. Jappel,** Sales Mgr.

Lincoln Park Industries—**Walter F. Cahill,** elected to Board of Directors.

Monthly Production of Motor Vehicles in U.S. Plants*

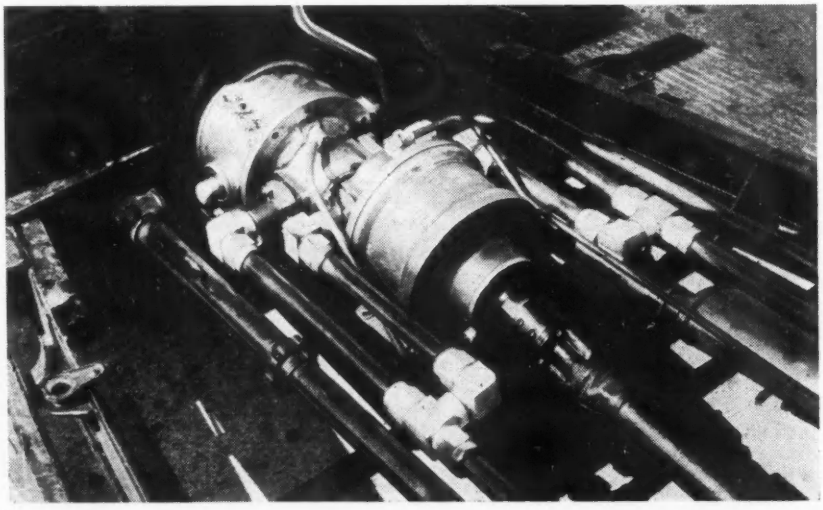
Passenger Cars	
January	58,775
February	47,665
March	90,045
Total — 3 Mos.	196,485
April	152,206
May	152,948
Total — 5 Mos.	501,639
Trucks	
January	54,684
February	28,692
March	39,459
Total — 3 Mos.	122,835
April	81,282
May	74,650
Total — 5 Mos.	278,767
Total — Cars and Trucks	
January	113,459
February	76,357
March	129,504
Total — 3 Mos.	319,320
April	233,488
May	227,598
Total — 5 Mos.	780,406

* Civilian Production Administration.

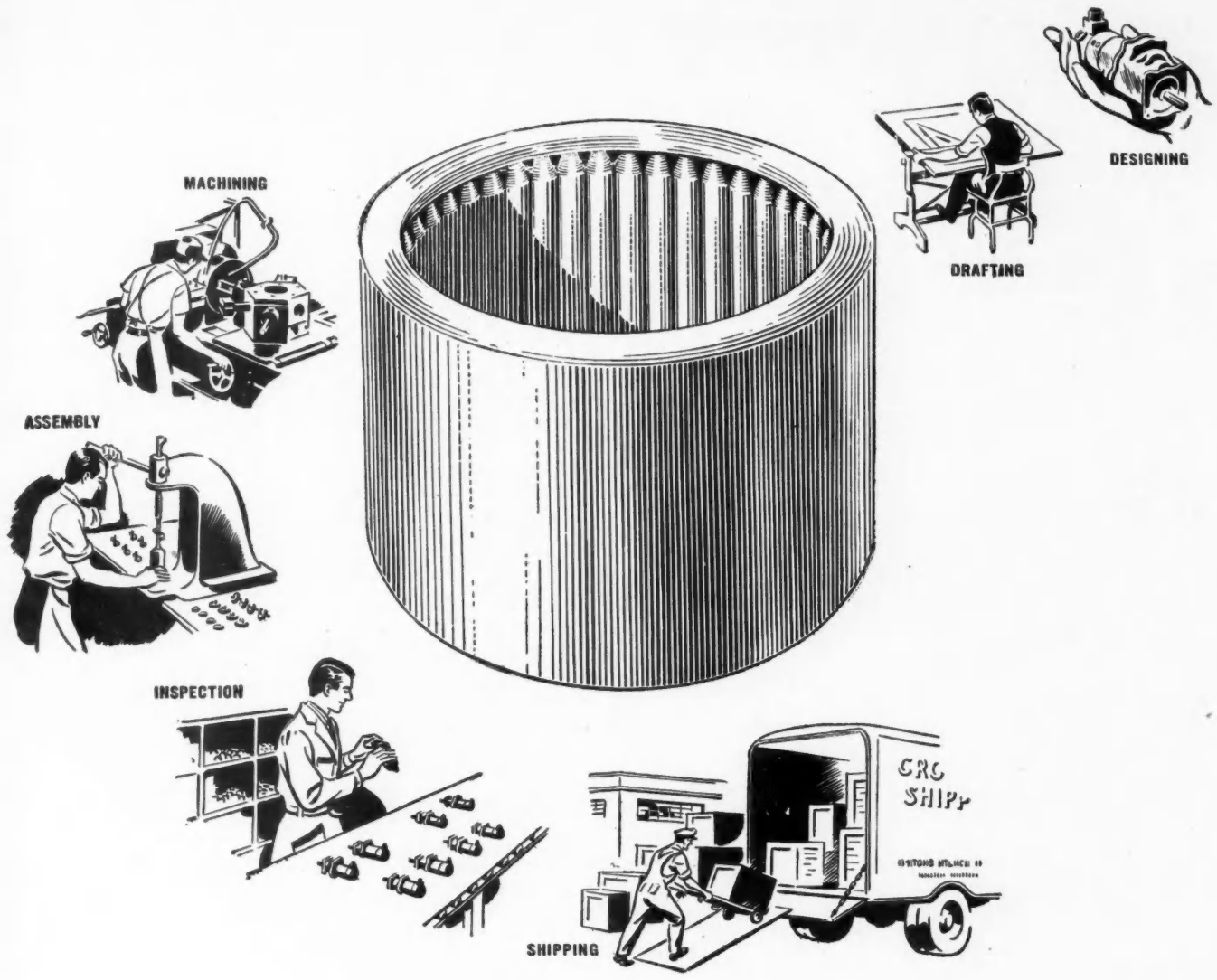
Bert Dingley Retiring as Marmon-Herrington President

A. W. Herrington, chairman of the board of directors of Marmon-Herrington Co., Inc., Indianapolis, Ind., announces that Bert Dingley is retiring as president of the company, effective July 1. He is to be succeeded by David M. Klausmeyer, who has resigned as plant manager of Chevrolet Commercial Body Division of General Motors Corp. to join Marmon-Herrington.

Experimental Hydraulic Drive



This illustration shows an experimental hydraulic drive installed in a Plymouth chassis by the Superdraulic Corp. The development consists of an industrial-type variable delivery pump and a standard industrial-type hydraulic motor, plus a small reservoir and an oil-cooling radiator. The pump and motor replace the regular clutch and transmission, and transmit power to the rear wheels through a propeller shaft and differential. Production models may be built soon with a high-pressure pump directly driven by the engine and small hydraulic motors installed in individual wheels.



Here's Anti-Friction Performance for Assembly Lines, too...

One thing about using Torrington Needle Bearings that the plant men appreciate is the way they can help to speed up the efficiency of assembly lines.

It's not only that their *unit construction* simplifies handling and speeds installation. The advantages start right back in the design stage where their small size and light weight help to solve many related design problems.

Then getting ready for production is easier, too. No elaborate tooling-up is necessary—a plain bore, machined to proper dimensions, provides the bearing housing.

Installation is a simple press fit...a single arbor press operation sets the bearing in position. No spacers or retainers are required to hold Needle Bearings in place.

And because of the efficient lubrication of this modern anti-friction unit, special or complicated systems for lubrication are never required. Even oil seals are unnecessary in many applications.

So, when you adopt the use of Needle Bearings, you can count on increased efficiency of your own production lines. And that's something we're all looking for these days.

Our engineering department will gladly assist you in securing full benefits from the use of Needle Bearings.

THE TORRINGTON COMPANY
TORRINGTON, CONN. SOUTH BEND 21, IND
Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

Light Aircraft Meeting of the Institute Of Aeronautical Sciences Held at Detroit

Assembly and testing methods used in mass production automobile plants must be supplied by builders of engines for personal aircraft if engine costs, which now are much too high, are to be reduced, in the opinion of Carl T. Doman, vice-president and chief engineer of Air-Cooled Motors, Inc. He was one of several speakers to address the Light Aircraft Meeting of the Institute of Aeronautical Sciences at Detroit June 13 and 14.

Use of automobile production methods, he said, would mean that parts reaching the assembly line must be of uniform high quality so that any need for hand fitting by specially skilled assemblers would be eliminated. Present aircraft engines, he said, cost about $4 per hp., but a goal of $3 is in sight and eventually cost will be brought down to around $2. That can be accomplished by permitting the engine manufacturer to simplify his design, by proper tooling and by purchasing materials in large quantities.

Engine accessories used for aircraft engines are altogether too high in cost, Mr. Doman said, and the apparent answer to that problem seems to be the use of mass-produced automotive equipment or variations of such equipment, at least for the present or until personal aircraft volume builds up to the point where accessories developed especially for aircraft engines can be produced more cheaply. He pointed out that such equipment as automotive starters, spark plugs, carburetors and similar accessories could be adapted to aircraft engines either as is or with some slight modifications. He also stated that experience has disproved the assumption that use of stampings in aircraft engines is impossible because of low volume. Considering all the costs involved in putting castings into production, he said, there are many instances where actual tooling cost is less with stampings. He cited one case where cost of tooling and patterns for an engine oil pan ran up to $19,200, whereas dies required to stamp out the same part cost about $5,200. Copper brazing in aircraft engine construction now is under experimentation, in connection with use of metal stampings, Mr. Doman said.

Speaking on simplified landing gear design, William B. Wescott, landing gear project engineer for Electrol, Inc., pointed out how weight control, cost of manufacture and material cost are important design factors. He said that if a standard landing gear could be used on a number of different light planes, manufacturing economies resulting from volume production could be effected. He stressed that costs can be lowered by a design in which fewer parts are required and in which most components can be machined automatically.

Reduction of noise from both engine and propeller was discussed by Grover Loening, aircraft consultant, National Advisory Committee for Aeronautics, and in a paper prepared by Theodore Theodorsen and Arthur A. Regier, of the Division of Physical Research, NACA. Mr. Loening said that noise is the No. 1 problem, since its nuisance character forces aviation to the outskirts of cities. The automotive engineers, he said, have made great strides in silencing automobiles, and he believes that aircraft engineers can do that same with aircraft. The difficulties are greater weight, loss of power and the propeller problem. In their paper, Mr. Theodorsen and Mr. Regier stated that the sound level of a plane can be reduced only by the use of a fan-type propeller with a large number of blades and low tip speed.

Mr. Loening said further that the personal plane industry has delivered between 7000 and 8000 planes so far this year and expects to build a total of between 20,000 and 30,000 in 1946. The greatest need, he said, is for airports and facilities near the vicinity of the owner. Other desirable developments he cited are aids for take-off and landings in small areas, such as cable and catapult drum, retarding cable devices for landing, possibly jet assistance (although this might be a fire hazard), or a landing wire device such as used by the Army. Greater range of cruising speed with higher maximum speed and some form of radar equipment for safe all-weather flying and detection of obstacles also were listed as desirable features for the light personal plane.

Recognizing that maintenance costs of the light personal plane are an important financial consideration, George H. Weitz, of the Non-Scheduled Aircraft Maintenance Division of CAA, recommended that manufacturers make easier maintenance a cardinal element of design and further provide mainte-

(*Turn to page 62, please*)

CALENDAR

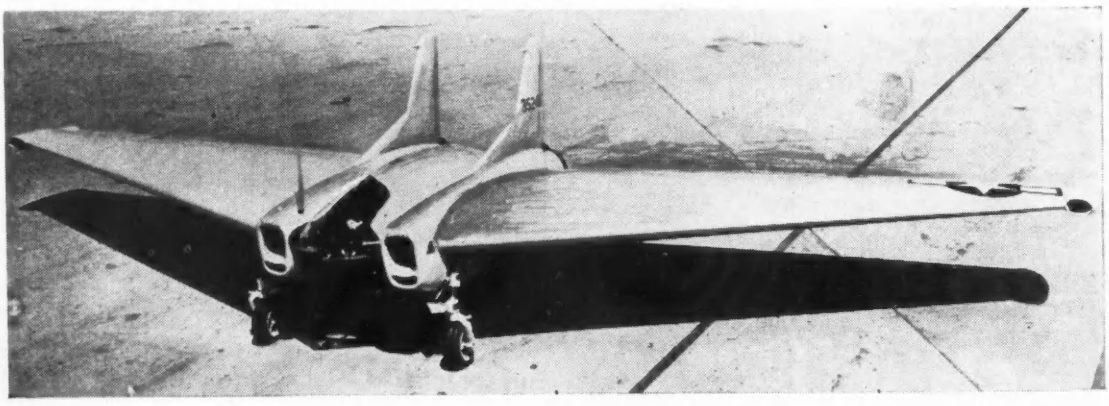
Conventions and Meetings

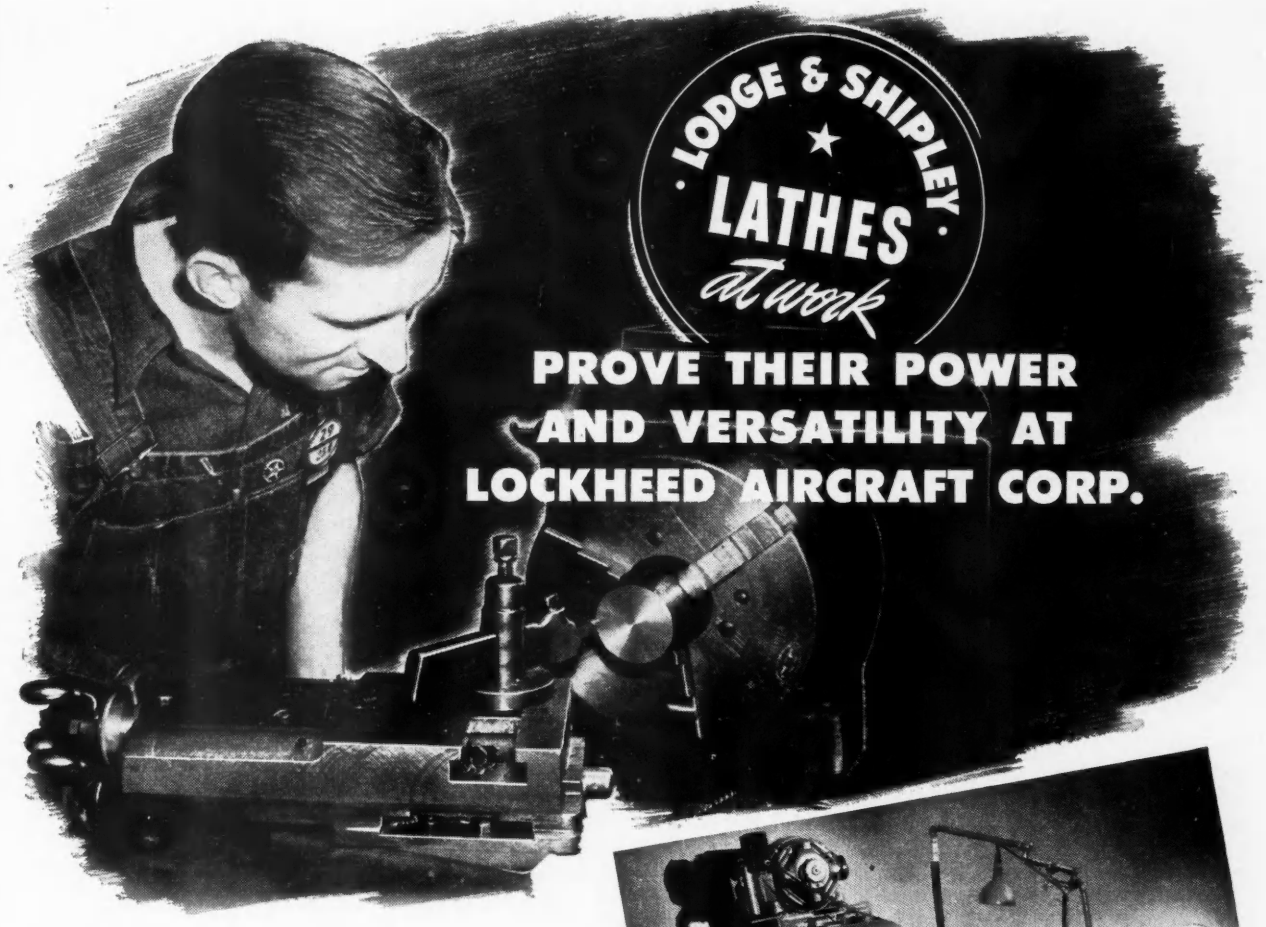
Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles	July 18-19
Municipal Airport Dedication & Sky Show, Mansfield, O.	July 20-21
1st Annual Revival Glidden Tour, Albany, N. Y.	Aug. 17-24
SAE Natl. West Coast Trans. and Maint. Meeting, Seattle	Aug. 22-24
National Air Races, Cleveland	Aug. 30-Sept. 2
Natl. Aeronautic Assoc. of Canada, International Air Show, Toronto	Aug. 30-Sept. 7
Natl. Chemical Exposition, Chicago	Sept. 9-13
American Chemical Soc., Chicago Semi-Annual Mtg.	Sept. 10-14
SAE Natl. Tractor Meeting, Milwaukee, Wis.	Sept. 11-12
Instrument Society of America, 1st Natl. Show, Pittsburgh	Sept. 16-20
Natl. Aircraft Show, Cleveland	Oct. 4-12
1946 Natl. Aviation Clinic, Oklahoma City	Oct. 14-17
SAE Natl. Transportation and Maintenance Meeting, Chicago	Oct. 16-17
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 7-8
American Welding Society Annual Meeting, Atlantic City	Nov. 17-22
Natl. Metal Congress and Exposition, Atlantic City	Nov. 18-22
SAE Natl. Air Transport Engineering Mtg., Chicago	Dec. 2-4
Automotive Service Industries Show, Atlantic City	Dec. 9-14

Northrop "Flying Ram"

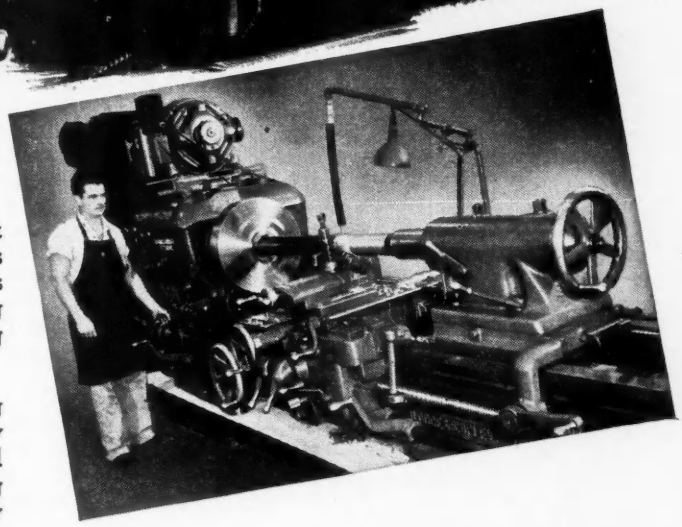
This small, compact Flying Wing fighter, the Northrop "Flying Ram", is piloted from the prone position, and is said to be capable of speeds in excess of 500 mph. It is only 14 ft long and has a wing span of 38 ft. Designated the XP-79, the jet-propelled fighter has two Westinghouse jets of 1400 lb thrust each.

Acme photo





PROVE THEIR POWER AND VERSATILITY AT LOCKHEED AIRCRAFT CORP.



L & S Lathes are busy at this famous plant giving new meaning to those old words "Power and Versatility." Illustrations show L & S 14″ and 25″ Lathes producing for Lockheed models that are creating aviation history.

Forming rolls, dies, fixtures, spinning chucks, shafts, screws, jigs and many other parts are produced quickly and efficiently. In working metals "ranging from non-ferrous alloys to extremely tough steels," this world-known firm reports: "the Lodge & Shipley Lathe is a rugged machine . . . it holds to tolerances of .0005 constantly and has the power needed in removing stock."

Standard high speed tools as well as carbide tipped tools are used in a wide variety of machining operations, such as "turning, boring, facing and threading." In addition to the production of parts for blanking, forming, mating and assembling of airplanes and parts, these L & S Lathes play an important part in maintenance replacement.

L & S Lathes possess tremendous strength, yet assure utmost accuracy and output. L & S Engineers will gladly discuss your special lathe problems, show you the advantages of these new, powerful machines. Write on your company letterhead for new condensed catalog.

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L & S LATHES

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Two Budd Companies Merge To Form New Corporation

An $80 million corporation known as the Budd Co. resulted from the merger of the Edward G. Budd Manufacturing Co. and the Budd Wheel Co., both Pennsylvania corporations. The merger was voted by shareholders of the two companies at their annual meetings held in Philadelphia.

Both companies were founded by Edward G. Budd, of Philadelphia, who pioneered the manufacture of all-steel automobile bodies, steel motor car wheels and modern stainless steel railroad passenger cars.

The new company owns all assets and business, and is subject to all liabilities of the two former companies.

The Budd Co. will be operated in four principal divisions—Automobile Body, Railway, Wheel and Induction Heating.

The Automobile Body Division, with plants in Philadelphia and Detroit, supplies automobile body units to Chrysler, Ford, General Motors, Nash and Studebaker, and fabricates stainless steel body assemblies for highway truck trailers.

The Railway Division designs and builds stainless steel trains of all types of passenger cars, including sleeping cars, reclining chair coaches, dining, lounge and observation cars.

The Wheel Division, with a recently enlarged plant in Detroit, supplies wheels to motor car builders and more than 200 truck and bus manufacturers. It also manufactures hubs, brake drums, brake mechanism and certain type of agricultural equipment.

The Induction Heating Division, with a separate new plant in Detroit, builds apparatus for heating of metals by electrical induction for heat-treating or forging.

Plants are in Philadelphia and Detroit, where 15,000 normally are employed.

Company Formed to Build Rolls-Royce Engines

Production in the United States of jet aircraft engines—the Rolls-Royce Nene and Derwent types—will be undertaken by the Taylor Turbine Corp., an American engineering-production group headed by P. B. Taylor, former vice-president and general manager of the Wright Aeronautical Corp.

Operating under a licensing arrangement with the British firm, Mr. Taylor's organization expects to be in production early in 1947. British-made Rolls-Royce engines will be available for American manufacturers in the interim.

The new organization plans to occupy plant space in Northern New Jersey. Completely independent of any other manufacturer, the group is in the process of setting up an engineering and executive staff and procurement of production personnel will start soon. The corporation will be initially financed with private funds, although a public stock issue is planned concurrent with the start of production next year.

The licensing arrangement with Rolls-Royce permits the Taylor Turbine Corp. to make such modifications as may be necessary to conform to American production an dthe organization will be able to carry on its own engineering, independent of the British concern. When newer gas turbine engine types are developed by Rolls-Royce, the Taylor firm will have the exclusive option for their production and sale in America. It is significant to note that Rolls-Royce is discontinuing the development of the Merlin engine in favor of turbo-jet engines.

Kaiser Special Features Announced by Company

General features of the 1947 Kaiser Special automobile were announced June 27 by the Kaiser-Frazer Corp. These features include a 100-hp, six-cylinder Continental engine, rear-wheel drive and box-type frame.

Helical springs are used on the front suspension, and semi-elliptic springs, rubber mounted with rubber inserts between the leaves, are used in the rear.

With an overall length of 203 in., the Kaiser Special has a loaded height of 64½ in., and is 72⅞ in. wide at its widest point. The front and rear treads are 58 and 60 in., respectively, and the tire size, 15 x 6.50.

Push-button door latches feature the interior appointments of the new automobile. Front and rear seats are both 62 in. wide. This width, approximately 64 in. from door to door, was achieved by moving the passenger compartment forward of both the wheel housings and the rear axle.

The engine, of L-head design, has a piston displacement of 226 cu. in., and a bore and stroke of 3 5/16 by 4⅜ in. The compression ratio is 7.3 to 1. Other power plant features include a forged, counterweighted crankshaft with four main bearings, rubber engine mountings and an automatic choke. The A.M.A. horsepower is 26.3.

Knudsen Elected to Board of Hupp Motor Car Corp.

General William S. Knudsen, former president of General Motors Corp., has been elected to the board of directors of Hupp Motor Car Corp., according to an announcement by R. S. Geddes, president.

Hupp, whose announced policy is that of contract manufacturing for several basic industries, will not re-enter the motor car field. Effective July 1, in clarification of its policy, the corporation name will be changed to Hupp Corp.

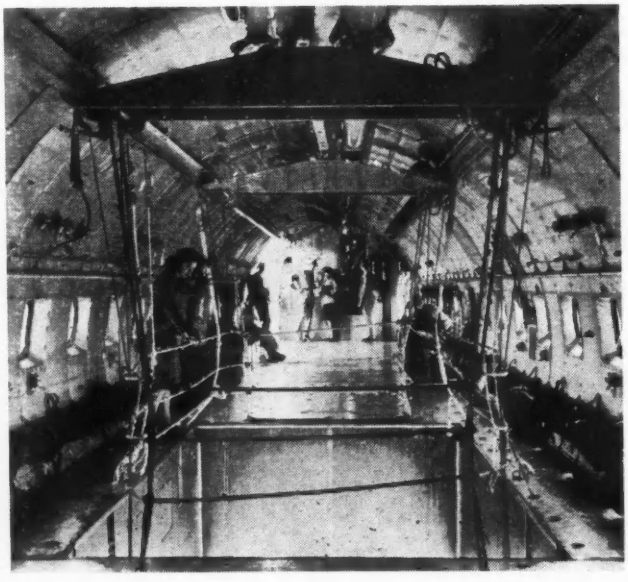
Coyle Predicts Peak Year Will Not Come Until 1948

M. E. Coyle, executive vice president of General Motors, predicted recently that the automobile industry would turn out about two million cars this year, would do considerably better in 1947, and would hit its postwar peak in 1948. He disparaged talk of a seven-million-car year, saying that about five million a year is the best that could be attained under the best circumstances. He pointed out that the industry has exceeded three million passenger cars a year only five times since 1929.

1947 Crosley Listed At $749 Retail

The retail list price of the Crosley has been set by OPA at $749, exclusive of state and Federal taxes, transportation, and preparations and handling charges. The car has been redesigned and improved over the prewar model, having a four-cylinder engine and greater size.

Inside World's Largest Transport



Here is an interior view of the C-74, world's largest transport plane, on display at the Army Air Forces show at Wright Field, Dayton, Ohio. The well in the foreground is used when lifting spare engines, cargo, etc.

Acme photo

World's Largest Plane Moved to Assembly Point

The largest airplane in the world, Hughes' H-4 "Hercules," was moved in sections to a Long Beach graving dock for assembly. Under construction at Hughes Aircraft Co. Culver City plant since March, 1943, the plane had to be moved in several sections over the 28-mile route. Each wing was moved separately, and the hull-fuselage and pontoons were individually transported. House-moving equipment was used and cost of the operation was $140,000.

Weighing 425,000 lb, measuring 320 ft from wing tip to wing tip, and with eight motors totaling 24,000 hp, the plane will carry 600 troops or 60 tons of cargo.

"Built almost entirely of wood, the completed plane, the world's largest, will represent a cost of approximately $20 million," said Howard Hughes, "but at that will have the lowest dollar cost per pound of any large experimental airplane."

Carrying 42 tons of fuel, the flying boat is expected to do 218 mph. Length of the hull is 220 ft, width 25 ft and height 30 ft.

Most Popular Cars at Automotive Exposition

The 12 most popular cars at the Antique Automotive Exposition, as determined by votes cast by 40,000 of the 175,000 visitors at the seven-day Automotive Jubilee event, were disclosed by Alfred Reeves, manager of the Exposition.

The largest number of votes—3052—acclaimed the 1911-1912 Bi-Autogo super-sports two-wheeler experimental car the most popular. Built by James Scripps Booth, of Grosse Pointe, Mich., this $28,000 vehicle won the first prize among individual entries.

About 2800 voters cast their ballots in favor of the 1896 Ford, Henry Ford's first automobile, as the most popular old-time vehicle among the manufacturers' entries.

To some 2278 voters, various 1946 model cars and trucks had the most appeal.

The 1911-1912 Bi-Autogo, which won for its owner and builder a Blue Ribbon and a set of tires, is believed to be the first large two-wheeled motor car in the world. It has an eight-cylinder V-type engine; a three-passenger, aluminum body; and two sets of "landing wheels" raised by a lever when the car attains a speed of 20 miles an hour. Earlier in the exposition, Booth's son, Lieut. John M. Booth, of Colorado Springs, Colo., won a Blue Ribbon for his Circa 1900 Benz, adjudged by a board of judges to be the oldest privately-owned car traveling in the June 1 Jubilee parade under its own power.

The Blue Ribbon given the 1896 Ford was the second Blue Ribbon award won by this early vehicle during the Jubilee Celebration. Earlier in the exposition, it had been adjudged the oldest car, regardless of ownership, entered in the June 1 parade.

Other prize winners among the individual entries included the 1900-1901 Knox entered by Frank J. Diebel, of Pigeon, Mich., which won second prize consisting of a Red Ribbon and radio; an 1896 Duryea, exhibited by Kirkland H. Gibson and George H. Waterman, Jr., of Providence, R. I., who won third prize, a Yellow Ribbon and car heater.

Manufacturers entering the competition ruled themselves ineligible for prizes but were qualified for ribbon awards. As a result of the voting for cars in this category, second prize went to the Oldsmobile Division, General Motors, for the 1910 Oldsmobile; third prize was awarded the "999" famous Ford racing car of 1902 vintage, once driven by Barney Oldfield. The vehicle was exhibited by the Edison Institute.

Allison Sets Up New Bearing Plant

Allison Division of General Motors has set up a new unit devoted exclusively to development and production of bearings. Designated the Allison Bearing Plant, it will contain all the bearings activities of the division and be located in the original Allison plant on Main Street in Speedway. B. L. Cruzan, who joined the Allison organization in 1918, has been named manager of the new unit.

News of the Industry

(*Continued from page* 50)

ufacturers to at least break even and possibly make a profit at present prices. Henry Ford II, however, recently disagreed with that assumption. At a press conference he said that even after the latest price increases allowed by OPA, the company can see no possible break-even point under present conditions of labor productivity. He added that this would hold true if the company were producing at the rate of 5400 cars a day, the volume which had been projected for this stage of reconversion. The full impact of rising material costs resulting from wage increases in supplier industries has yet to be felt, he said, adding that more than half the cost of the car is for purchased materials and that so far, material and parts costs have increased 30 per cent over prewar. He pointed out that while productivity was off 34 per cent in January, it will be impossible to tell what the current rate is until volume production is attained. John Bugas, Ford vice president, reports that there has been some improvement in worker efficiency and that a trend toward increased productivity is discernible, but not measurable under present low volume output.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

A sharp rise of general business activity from the lowest levels reached in May has been indicated. The *New York Times* index for the week ended June 8 stands at 125.9, as compared with 116.0 for the preceding week and 142.8 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended June 8 equaled 272 per cent of the 1935-39 average, as compared with 223 in the preceding week. Sales were 39 per cent above the corresponding distribution in 1945, as against a like advance of 32 per cent for the week before. The total in 1946 so far reported is 27 per cent greater than the comparable sum in 1945.

Electric power production increased substantially during the week ended June 8. The output was 9.4 per cent below the comparable amount last year, as compared with a similar recession of 11.0 per cent in the preceding week.

Railway freight loadings during the same week totaled 830,126 cars, 32.4 per cent more than the figure for the week before but 6.2 per cent below the corresponding number a year ago.

Crude oil production in the week ended June 8 averaged 4,895,650 barrels daily, 139,750 barrels more than the average for the preceding week and 42,236 barrels above the comparable figure in 1945.

Bituminous coal and lignite production during the week ended June 1 was estimated at 3,700,000 tons, as compared with 7,950,000 tons in the week before and 11,132,000 tons a year ago. The output in 1946 so far reported is 25.9 per cent below the corresponding production in 1945.

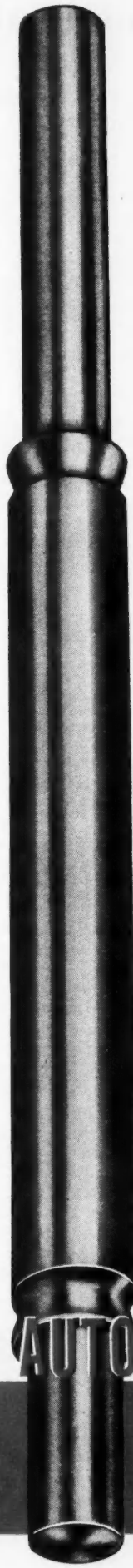
Civil engineering construction volume reported for the week ended June 13 by *Engineering News-Record*, $138,911,000, is 24 per cent less than the figure for the preceding week but 135 per cent above that reported a year ago. The total recorded for twenty-four weeks of 1946 is 204 per cent more than the comparable sum in 1945. The increase shown for private construction is 585 per cent, and the advance in public construction is 53 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended June 8 is 111.5 per cent of the 1926 average, as compared with 111.1 for the preceding week and 106.0 a year ago.

Member bank reserves increased $110,000,000 during the week ended June 12. Underlying changes thus reflected include a rise of $446,000,000 in Reserve bank credit and a gain of $466,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a reduction of $31,000,000 in money in circulation.

Total loans and investments of reporting member banks declined $556,000,000 during the week ended June 5. A decline of $13,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $7,469,000,000, shows a net increase of $1,647,000,000 in twelve months.

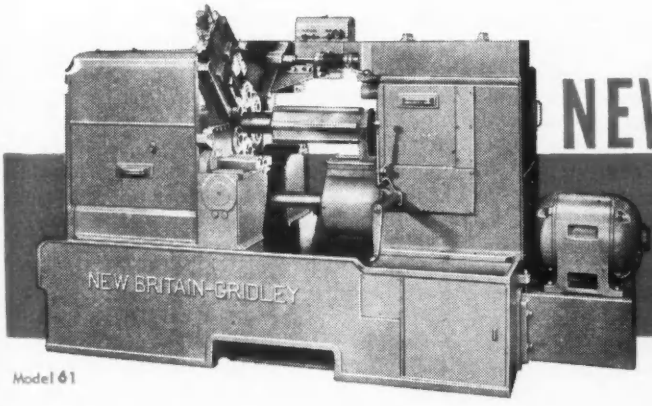
LEADERSHIP BASED ON ACCOMPLISHED FACTS



This motor armature shaft, made by a well-known electric motor manufacturer, is 9-25/32" long, with a .686 diameter. When turned on a New Britain Model 61 Six Spindle Automatic Screw Machine using free cutting screw stock, the rate of production is two hundred and ten pieces per hour. Because the stock is supported by a rotating pick-off spindle, with a roller support close to the cutoff tool, the part is finished at both ends with no cutoff burr left. Nine operations are performed in seventeen seconds.

Whether your work calls for small pieces or large, complex or simple, you can find the most logical answer in New Britain Multiple Spindle Automatics *plus* the engineering know-how of our tool layout specialists. When the subject is high production and low cost per piece, it's time to talk with the New Britain representative in your locality.

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION



Model 61

NEW BRITAIN AUTOMATICS

M-01041

Equitable Distribution of New Cars

(*Continued from page* 17)

stronger, and more competitive dealers.

Packard has inaugurated what it calls the "open book" policy of distribution of cars to dealers. Figures are compiled daily showing just where the cars are going and any dealer who believes he is not getting his full share is free to examine the records. Packard is using the historical sales base (1941-42) in conjunction with sales potential. This results in some adjustment upward or downward of the historical base, depending upon what the particular market survey shows for a particular dealership.

Ford is on a straight historical basis. A company spokesman says that some consideration may be given later to changes on sales potential, such as might be caused by population shifts, but for the present, the volume of production does not warrant a change.

The Chrysler divisions base allocations on a combination of historical sales record and sales potential. Since Dodge, DeSoto and Chrysler dealers all sell Plymouth cars, each of the three divisions is allocated the same percentage of Plymouth production that it took during the last three prewar years. Chrysler sets up no factory reserve, and all sales to government agencies and other sources usually handled from the reserve are made through dealers. Hudson also is reported to use the combination of sales potential and historical base in its allocations.

Special consideration to returned veterans also imposes some problems in distribution. Some dealers are earmarking as high as one car in three for veterans, others fewer, but the demand is so great that veterans probably could take the bulk of the production so far. When veteran orders are given preferential treatment, the delivery of persons who may have been on the list for a long time is slowed up.

It should be remembered that the car manufacturers themselves have no direct control of deliveries after the cars are in the dealers hands. The company does, of course, have the power to revoke a franchise for cause, such as illegal sales or some other action which is detrimental to the company's interest. There is a report circulating in trade circles in Detroit that one dealer is under tentative cancellation for Mexican deals at above ceiling prices and that at least one other is to be cancelled out soon for faking repair prices and for accepting money to move a customer up on the list.

Another charge frequently heard is that the delivered price of the car is greatly increased by "loading" it with accessories which the buyer neither ordered nor wants, such as seat covers, fog light, directional signals, radio, and similar devices. Whenever such cases occur, and they admittedly are in the minority, they are the work of the dealer and not the factory. A spokesman for one of the companies reports that a dealer had loaded a car with more than a hundred dollars worth of extras, and when the customer protested, told him that the car had come from the factory with the accessories installed. The buyer protested to the company, which took stern measures with the dealer.

In general, it can be said that both manufacturers and dealers are doing an excellent job in distributing available cars equitably, especially in view of the terrific pressures to which they are subject and the limited number of cars available. There will continue to be dissatisfaction with deliveries as long as demand is in excess of supply. There will continue to be a very few dealers who will put immediate gains ahead of long range good will. However, most dealers will follow the policy expressed by one large Detroit dealer, who said: "I've got a $150,000 business here. In the next few years I'm going to make a lot of money and I want to stay in. Do you think I am going to risk my franchise and reputation for a few hundred dollars?"

Automotive manufacturers have a definite stake in urging that dealers insure fair distribution of new cars to customers. They are recommending that wherever possible dealers adopt policies which will best serve the needs of customers on the first come, first served basis.

The following statement by J. R. Davis, vice-president in charge of sales and advertising of Ford Motor Company, is typical of the attitude of all automobile manufacturers: "It is no surprise to me that the duly franchised automobile dealer is not guilty of black market operations. And there are two very good reasons: Each is in business for the long pull and is not a curbstone or overnight operator. He thinks too much of his business operation. Ford dealers have in the neighborhood of $100,000 each invested in their business. Any risk that they would take in black market operations would be far too great."

Light Aircraft Meeting Held at Detroit

(*Continued from page* 56)

nance representatives for their product. He emphasized that improved liaison is needed between the manufacturer and the repair station.

Passenger comfort in light planes appears to have been given secondary importance to other features of design, according to F. K. Teichmann, head, Department of Aeronautical Engineering, New York University. He presented a paper on optimum seating arrangements for light planes, in which he pointed out that several factors influence seat placement, such as comfort, frontal area, access, safety, vision, center of gravity, vision and baggage room. He did not present any definite conclusions, other than that seating should provide at least the comfort of an automobile seat. In the discussion which followed the paper, several participants suggested that passenger comfort and ease of handling should be given prime consideration, even at the sacrifice of some aerodynamic efficiency.

J. M. Gwinn, Jr., chief engineer, Personal Aircraft, Consolidated Vultee Aircraft Corp., discussed the effect of center of gravity on safety of personal aircraft. He stated that cg shift must be held to a minimum to minimize stall hazards, make maneuverability of two-control planes uniform, and improve taxiing and cross-wind characteristics of the tricycle landing gear.

Because plane controls are affected by torque, yaw and change of trim with engine power, new standards of stability and control developed to fit the pilots' needs more accurately are needed, Wolfgang Laneweische, research pilot for the Kollsman Instrument Div., Square D Co., told the meeting. He said that there is need for a spirally stable airplane which will straighten out and fly straight after a turn when the pilot's hands and feet are off the controls. He thinks it is possible to design a plane that will resist the tendency to climb when engine speed is increased and that will react predictably to controls in the hands of the pilot.

Pan American Purchases Convair-240 Type Clippers

A $4,500,000 contract for the purchase of 20 Convair-240 type Pan American Clippers was announced by Pan American World Airways. The 300-mile-an-hour, 40-passenger transports are scheduled to join the Pan American Clipper Fleet next summer. The contract with Consolidated Vultee Aircraft Corp. provides for an option on an additional 30 planes, it was announced.

Wagnerian Unwisdom

(*Continued from page* 15)

force." Is this not true?

The same or similar elements in Congress as proposed and carried through the Wagner Act, now, even more vigorously, oppose any change in our present labor laws and any proposals to enact restraining legislation for the correction of obvious major evils which thrust at the very heart of the American Way. We can be sure that their present warnings and cautionings are worth no more than the utopian promises they offered before they saddled us with the vicious Wagner Act.

PANTASOTE UPHOLSTERY — Pantasote's new plastic upholstery adds sparkle and comfort to modern railway interiors.

PANTASOTE CAR CURTAINS—made from two laminated fabrics to prevent wrinkling and to give added strength, longer wear.

PANTASOTE VESTIBULE CURTAINS — for cleaner, brighter, well-protected railway vestibules.

3 PANTASOTE PRODUCTS — each specifically designed for railway uses. That's why Pantasote has been standard on railroads for over half a century. Pantasote Products age well, remain good-looking year after year, and are manufactured in a wide variety of colors and finishes. They're easy to clean, too — just wipe with a damp cloth.

THE PANTASOTE CORPORATION OF NEW JERSEY, 444 Madison Ave., NEW YORK CITY 22

Ford of Canada Production

(*Continued from page* 25)

line, for example, Ford has installed two, 2-way 8-spindle Ingersoll boring machines of the latest type—one for rough-boring, the other for semi-and finish-boring of cylinders. It is claimed that with the two machines it is possible to produce bores suitable for honing in contrast with the former practice of using three machines for the same purpose. By the use of multiple tooling, the finishing machine is said to be more productive than the so-called "fine boring machine" and the overall investment, naturally is lower.

The rough-boring Ingersoll machine is capable of producing bores at the rate of 44 blocks per hour at 100 per cent efficiency. It removes stock not to exceed 5/32 in. on the radius of the bore; and locates bores to within 0.008 in. of true location. Eight-bladed cutters fitted with cemented-carbide tips are employed.

The Ingersoll for semi- and finish-boring handles blocks at the rate of 39 per hour at 100 per cent efficiency. Spindles are arranged to feed both ways, using 6-bladed cutters tipped with cemented-carbide. Three of the blades are adjusted to the semi-finish diameter, three to the finish diameter. The return stroke is merely a "dusting" cut. The bores thus produced are within 0.001 in. for roundness, taper, and diameter, and the finish is such that tool marks can be removed readily by honing. The finishing machine is located adjacent to the honing machine, both using the same kerosene cutting fluid system.

The crankshaft line, although basically the same as before, features a number of new machines, including two LeBlond 1-LB crankshaft lathes, one of the latest type Landis crankshaft grinders, and a new Tinius-Olsen crankshaft balancing machine.

The LeBlond crankshaft lathes are of single-spindle, single center drive type and are automatic in cycle. They are equipped with separate sets of tooling for simultaneously rough- and finish- turning all line bearings, the flange and stub ends. The three sets of tool units operate in an automatic cycle, controlled by push buttons. Two sets of oppositely moving cutting tools rough the line bearings, followed by a set of finishing tools moving in from a third direction to finish the previously roughed surfaces. Since there is no indexing in the cycle, there is no loss of time between the roughing and finishing operations.

The cradle houses the finishing unit which provides positive, smooth dwell of pre-determined duration for sizing the work. It also contains the coolant system and acts as a chip guard and apron for the protection of the operator. As illustrated, the machine has been equipped with an air lift at both ends for handling the work. The fixture at the left is used for loading, the one at the right for unloading.

As tooled for the Ford crankshaft, these machines operate at 36.2 rpm, with feeds of 0.00539, 0.015, 0.0216 and 0.040 in. per revolution. Stock removal is heavy as may be visualized from the following figures:

On flange main bearing .....5/32 in.
On flange around oil slinger.....5/8 in.
On stub end .....5/16 in.

It is of interest to find that the company is engaged in the erection of a new addition to the machine shops which will house equipment of advanced type for next year's production. This department will be described for our readers at the proper time, early in 1947.

Soaring and Gliding Contest to be Held at Elmira, N. Y.

The 13th Annual National Soaring and Gliding Contest, first since the end of world hostilities, will be held Aug. 3-18 inclusive at the "Harris Hill" soaring site at Elmira, N. Y. All indications are that this will be the biggest national contest ever held.

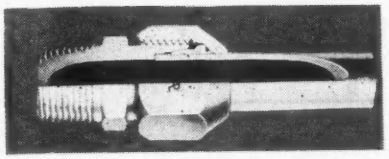
NEW PRODUCTS

(*Continued from page* 46)

paint from conveyor hooks and spray booth louvers. The removal of frit in the vitreous enameling field is also one of the various other applications of Triad PR.

Flareless Fitting for All Types of Metal Tubing

The Parker Appliance Co., Cleveland, Ohio, is making a new fitting for use in joining all types of metal tubing, including ¼ hard stainless steel, in hydraulic and fluid-conveying systems. Eliminating the need for special flaring and assembly tools, brazing or soldering, the new fitting incorporates a steel ferrule which, when body and enclosing nut are tightened up, acts to cut a shoulder in the tubing itself, thus providing a tight sealing grasp for the assembly. The fitting is expected to be particularly useful in high-pressure application and in installations where thick-wall tubing is used.

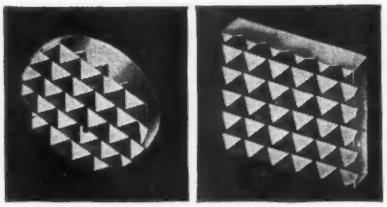


Cut-away view of Parker fitting

Silver-Molybdenum Alloy

The Callite Tungsten Corporation, Union City, N. J., offers a versatile new silver-molybdenum alloy called "Callinite Type SM." This Callite product is said to be particularly suitable for facing of contact surfaces in switch gear designed to handle heavy currents. Callinite Type SM alloy is a high conductivity facing material suitable for applications requiring high current where pitting, sticking or welding of contacts occurs. It is produced in standard and special shapes.

Gripping Inserts of Solid Kennametal



Kennametal, Inc., 1 Lloyd Ave., Latrobe, Pa., is now producing these "Kengrips," for use as gripping inserts in various holding, clamping, and feeding devices. As shown in the illustrations, "Kengrips" are made of solid Kennametal, in the forms of discs and squares, with diamond serrated surfaces. Four sizes are now available; in either form, as follows: ½ in. by ⅛ in. thick; ⅝ in. by ⅛ in. thick; ¾ in. by 5/32 in. thick, and 1 in. by 5/32 in. thick

Veneer Bearing Retainers

German use of a compressed, molded veneer to form retainers for high-speed ball and roller bearings has been revealed by 13 American experts who investigated German developments in forest products. German tests of the wooden bearing retainers are said to indicate that they are superior to the metal retainers now used. Another German development which may prove useful in the United States, in the investigators' opinion, is a process for rapid, continuous fermentation of alcohol or protein food yeast from wood sugar. Germany's wartime capacity for alcohol production from wood sugar was 35,000,000 liters and for yeast production 25,000 metric tons annually. Another development was the use of prehydrolyzed pine pulp chips in the preparation of high strength rayon tire cords.

Abstracts of SAE Papers

(*Continued from page* 37)

We have run an 8.5 in. by 11.5 in. experimental engine in a field installation with aluminum-tin connecting rod bearings with a maximum unit loading of 2040 psi for over 9000 hr with no noticeable deterioration of either bearings or shaft, the shaft in this case being of SAE 1045 heat treated to approximately 160 Brinell. The load factor on this engine over the entire test period was 82 per cent. Babbitt lined bearings were not satisfactory in this engine.

One case of scuffing occurred when an aluminum bearing was installed on the crankpin of a heavy-duty single cylinder four-cycle natural gas engine for oil field service. The bearing in this engine is necessarily fitted very close and is splash lubricated. Several attempts at running were made, but the combination of the close fit and high operating temperature, caused by the lack of oil in quantity for cooling, resulted in bearing seizure. On disassembly the bearing material would be found to be badly scuffed, but the shaft would be undamaged. It is interesting to note that a SAE No. 30 babbitt-lined bronze backed bearing is satisfactory in this application.

By G. B. Grim
Caterpillar Tractor Co.

There have been indications of possible trouble with scoring or galling under severe loading conditions, with momentary metal-to-metal contact, as in starting before sufficient oil has been distributed. The high silicon material is expected to provide at least a partial solution to this problem.

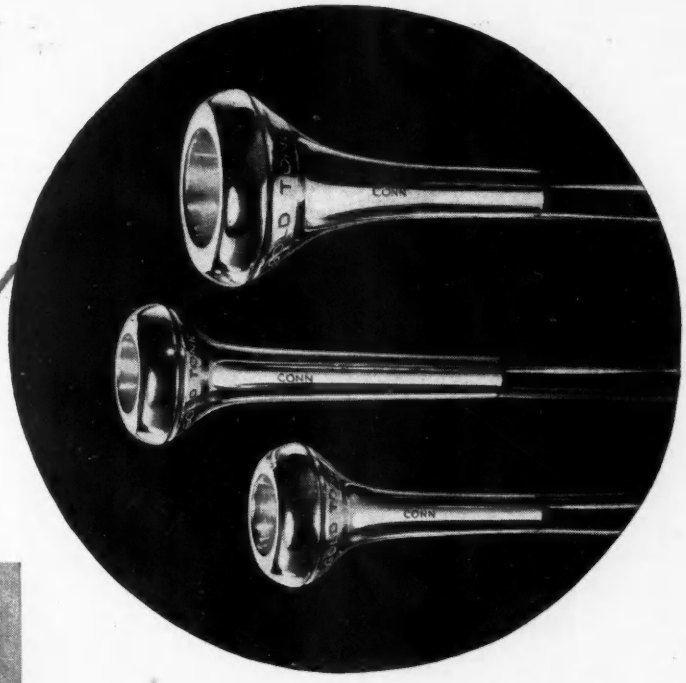
Particles of dirt carried by the lubricant have imbedded themselves in bearings, and some have scored the bearing surface; but in no case has dirt caused failure, except when the load was so near the material's limit that only a slight disturbance was required to upset the equilibrium of the conditions. The aluminum materials do not engulf foreign partcles, as do the softer materials; but the particles—at least in moderate quantity and size—have been sufficiently imbedded to avoid serious damage to the bearing. When the journal hardness is as high as is required for optimum service with aluminum bearings, foreign particles do not score the journal.

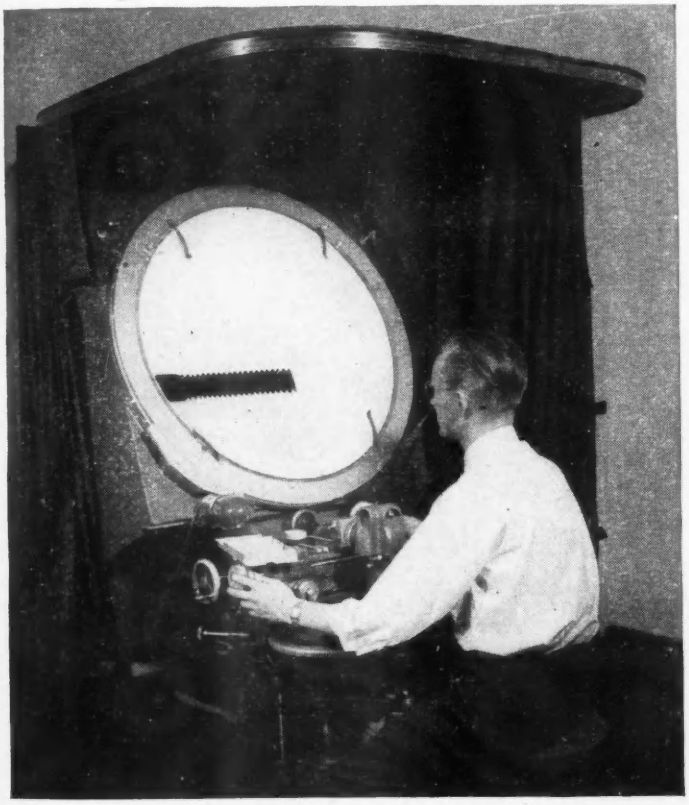
Our experience with bearings which have seized to the journal closely parallels that of the author; the journals are not permanently damaged, and any adhering bearing metal may be easily removed.

In general, we have found it necessary to maintain higher initial clearance between the aluminum bearing and its journal than was necessary with babbitt. This may be partly due to

(*Turn to page* 70, *please*)

Scarcely THICKER THAN A Hair!





Photographs courtesy of C. G. Conn, Ltd.

Small screws and threaded rods scarcely thicker than a hair, small musical instrument parts and peculiarly shaped tools that form the curves of cup mouthpieces are inspected on Jones & Lamson Optical Comparators.

This method of inspection enables the manufacturer to control the precision and high quality of these musical instruments at the source—rapidly and economically.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

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the initial growth of the bearings, which we have observed during the first hundred hours or more of operation. The phenomenon might be avoided by heat treatment in the final stage of fabrication, but this has not yet been done.

Gy G. E. Burks
Caterpillar Tractor Co.

ALUMINUM bearing alloy is used in all Caterpillar Diesel main and connecting rod bearings; likewise, aluminum bearings are being serviced to engines in the field which were originally equipped with babbitt bearings.

Conformability and imbedibility are factors which should not be too seriously considered. Good structural design of bearing supports and crankshaft with a greater degree of perfection applied in the manufacturing processes obviates the need for conformablity, at least to within a limited degree. Likewise, cleanliness of the bearing lubricant reduces the imbedibility factor. There is little of either of these two factors present in the precision type micro-film white metal bearings. The load rating of the aluminum alloy would be greatly depreciated should it prove necessary to equal the imbedibility or conformability factor applied to the normal white metal bearing.

In those tests which have been conducted to study relative wear of the crank journal with aluminum versus babbitt, we have been unable to determine any marked difference which would favor either bearing material.

As we look at aluminum bearings that are presently being used in the Caterpillar Diesel, we would have no reason to wish to introduce a bi-metal bearing, such as the aluminum on a steel back. This we fear would be inviting the hazards of insecure bonding of the aluminum alloy to the steel, and under our present operating conditions, such as load, temperature and rigidity of bearing supports we see no need for anything but the solid aluminum bearing. We look upon the steel back bearing as possibly being most suited to replacement of thin-walled bearings or for use where bearing temperatures are above that which cause the solid aluminum bearing to exceed its yield strength and, thereby, present the hazard of becoming loose.

Packard Marine Engine

(*Continued from page* 32)

ribbed and provided with adequate sealing and oil control rings, four rings being installed above the wrist pin. Hardened alloy steel wrist pins are of full floating type retained with an aluminum button at each end.

The two valve housings, comprising the upper structure of the engine. are fitted between the tops of the cylinder barrels and the camshaft. They are made of aluminum castings bolted to each bank of cylinders to form an integral cylinder block structure. These housings carry the camshafts, rocker arms, valve stem guides, and exhaust manifolds. Individual exhaust ports are flanged in pairs while inlet ports are connected by a gallery in groups of six.

Four valves are used per cylinder—two exhaust and two inlet—located in the cylinder head and operated by the overhead camshaft through end-fulcrum rocker levers. Valve ends are provided with self-aligning tappets of special alloy steel. Exhaust valves are salt-cooled and seat in Stellite-faced valve seats, completely surrounded by cooling water. Double concentric valve springs are used. It is of interest to find that with progressive changes in engine output the geometry of the valve heads has been suitably altered to meet the requirements.

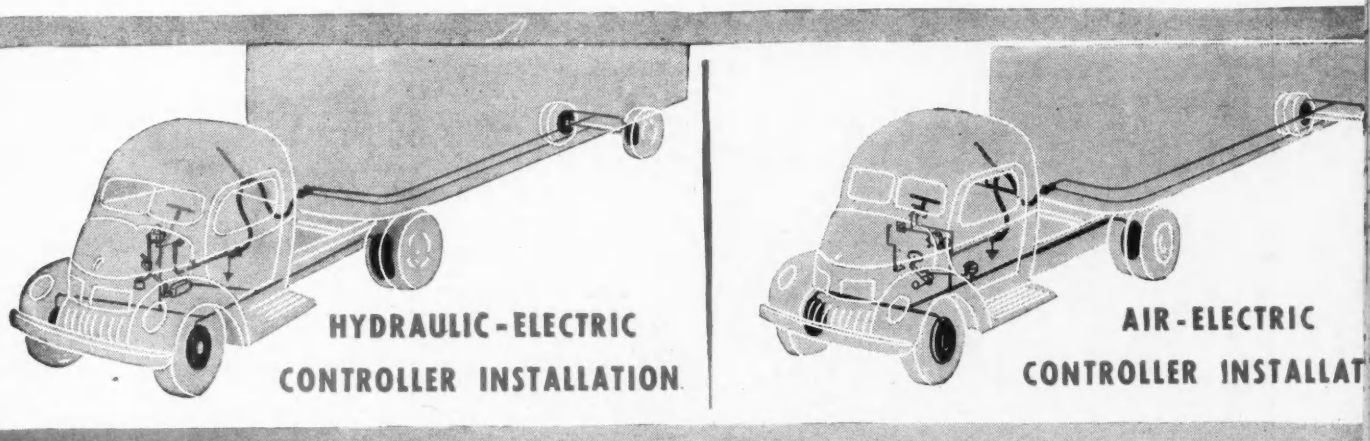
The design of rocker levers is noteworthy. They are pivoted at one end and are arranged to operate pairs of inlet and exhaust valves. Cam contact is made with a roller which is mounted on a riveted pivot in a slot in the lever and rolls on an anti-friction needle bearing.

Fire hazard is eliminated by the use of flame trap screens at inlet valve

(*Turn to page* 74, *please*)

BRAKE ACHIEVEMENT...

Synchronizes Either Type of Tractor Brakes with Trailer Electric Brakes so Foot Pedal Operates ALL Brakes Together



HYDRAULIC-ELECTRIC CONTROLLER INSTALLATION

AIR-ELECTRIC CONTROLLER INSTALLAT

Controller is easily and quickly fitted into tractor's hydraulic brake line.

For tractors with air brakes, the Controller installation can be made with equal speed and ease.

FOOT PEDAL PRESSURE CONTROLS BRAKES ON *Both* TRACTOR AND TRAILER

WARNER
ELECTRIC BRAKES

ports, as illustrated. Crankcase breathers are vented to the atmosphere at the flame arresting air cleaner.

The two overhead camshafts are of forged alloy steel, hardened and ground, and driven from the crankshaft by a train of gears, one for each bank, as illustrated. The camshafts are carried in aluminum alloy pedestal bearings mounted on the valve housing.

The supercharger is of centrifugal type driven from the crankshaft end by a quill through a step-up train of spur gears having a ratio of 7.64 to 1. The main drive gear mounted on the quill extension is of special flexible construction—the gear being made up of two sections retained by coil spring shock absorber elements—so as to reduce inertia and reverse torque loads induced by sudden changes in engine speed. This is a vital consideration in a marine engine for the protection of the extremely high speed impeller. The supercharger is mounted, as shown, in the front end of the engine in the induction system between the carburetor and inlet valves.

The stepped-up speed supercharger was one of the design changes responsible for the great increase in the performance of the current type engine. This change made it desirable to introduce an aftercooler which is located at the top of the front end of the engine between the discharge side of the supercharger and the inlet manifolding. Its function is to reduce charge temperature at high engine output. The aftercooler is cooled by the salt water system, this function being controlled by an automatic pressure valve operative only at certain pressures.

Intake manifolding and porting is specially designed for even distribution of the mixture. The exhaust manifold is of aluminum alloy, water-jacketed in conformity with marine engine practice, and cooled by the salt water system. It is suitably treated to resist salt water corrosion.

Auxiliary drives are provided at the supercharger end of each camshaft—one for tachometer drive, another for transmitting 3½ hp for special accessories. Provision also is made for the installation of an auxiliary drive of 8½ hp on the valve housing opposite the gasoline pump.

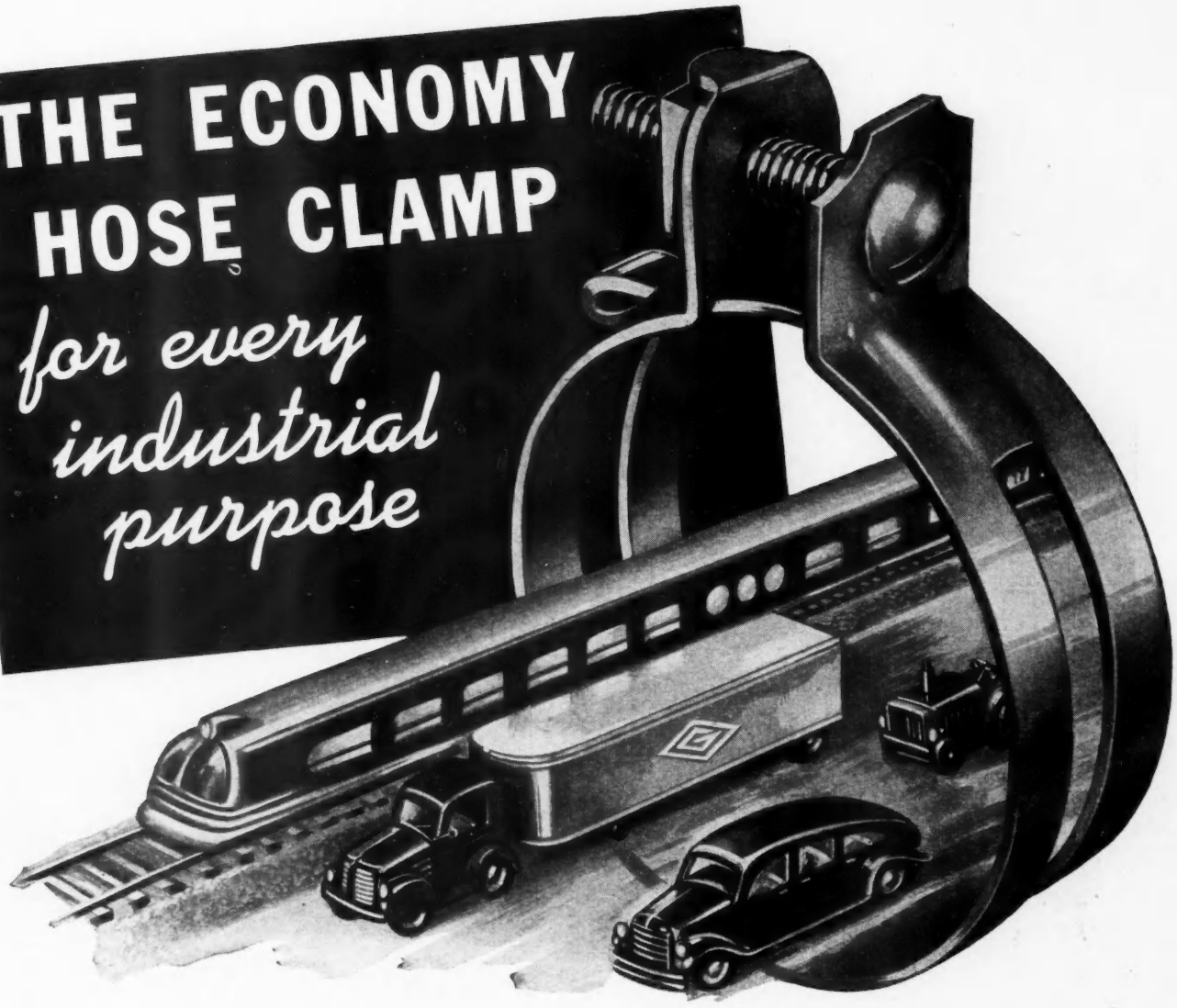
Examination of the cross-section of the engine at the supercharger end will show the vertical drive from the crankshaft supplying the drive to the lower end for the oil pump and the fresh water circulation pump for the cooling system. Both pumps are accessible from the underside of the engine. The engine lubrication system is of dry sump type with a multiple gear type positive displacement pump. The first two stages of the oil pump are used for scavenging while the pressure circulating stage—a larger capacity pump—is at the extreme left or rear end of the pump. As shown, the circulating stage is driven from an externally mounted gear train driven by the shaft of the second stage scavenging pump. Oil is circulated to the main bearings, connecting rods, and all other bearing points through oil galleries and drilled passages. The normal inlet oil temperature is held to 140 F.

The cooling system is operated by the centrifugal pump, mentioned above, provided with double outlets for connection to the water manifolds on each bank of cylinders. Each cylinder bank also is provided with water outlet fittings. Distilled fresh water circulated in the engine is cooled by salt water in an external heat exchanger. The cooling system is so adjusted that the water circulating outlet temperature is held at 150-170 F.

A salt water pump is mounted on the supercharger end, driven at crankshaft speed. This provides the cooling for the exhaust manifold at low engine speeds; and supplies the flow to the manifolds and aftercooler at moderate and high speeds. The increased flow required for the heat exchangers at moderate and high speeds is obtained by a suitable salt water scoop system provided by the shipbuilder.

Automatic overspeed protection is offered by grounding the ignition, effective at an engine speed approximately 10 per cent over the maximum emergency operating speed.

THE ECONOMY HOSE CLAMP *for every industrial purpose*



MAXIMUM CLAMPING POWER CUTS LEAKS...LOSSES...REPLACEMENTS

For maximum clamping power on hose lines where you want to cut leaks . . . reduce losses . . . and eliminate costly replacements—specify Diamond G Hose Clamps. For connections in automotive, pneumatic, hydraulic, electric, marine, railway, and other applications, they are the economy clamp for every industrial use.

Diamond G Hose Clamps have been designed, developed, and proved in service to be the ideal clamp where low cost and high operating efficiency are the key factors.

Each and every Diamond G Hose Clamp is rust proof for protection and long life under all operating conditions. The "captive" nut, guarded by sturdy flanges, assures a positive tight grip. Heavy duty reinforced shoulders, plus powerful spring action provide uniform pressure and grip around the circumference.

Whatever your need in hose clamps, Diamond G has the answer for you. A complete range of sizes for delivery of air, water, gasoline, oil, and chemical. For full details write—

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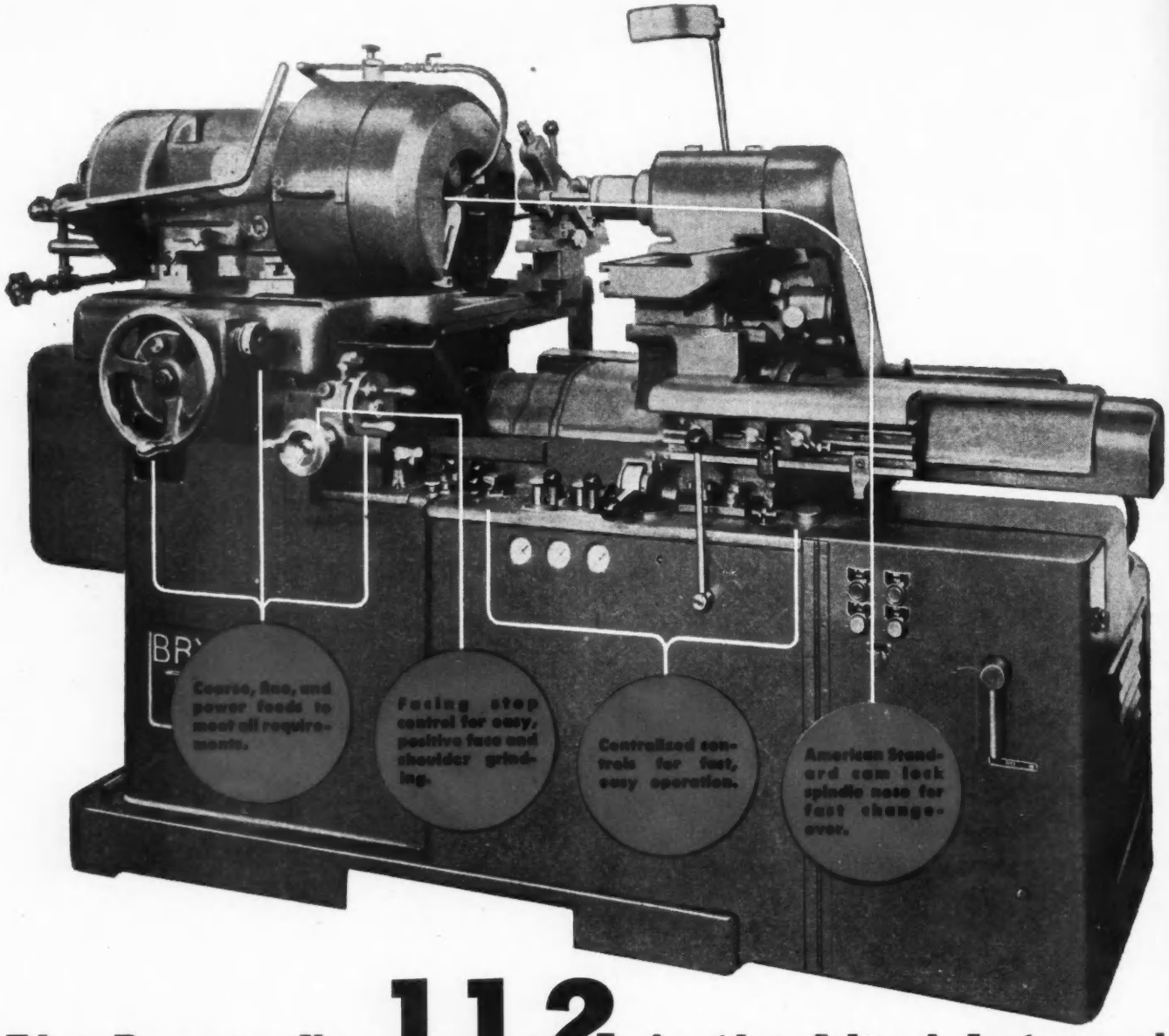


The BRYANT No. 112 is the Ideal Internal GRINDER for Small Lot Production

From stem to stern, the Bryant No. 112 Internal Grinder is designed for small lot production. It is truly the *ideal* tool room machine, because every lever, every control, every part was planned to speed the production of short runs or single parts.

There are three feed controls—one for coarse feed for setup, another for power feed for production, and a third for fine feed for precision.

An American Standard cam lock spindle nose allows fastest change of chucks and holding fixtures.

All controls are centrally located so that all of the operator's motions are easy and natural—more work produced with less fatigue.

A universal facing stop (standard equipment) makes face and shoulder grinding an easy, positive operation.

These are only highlights—for complete details on this "ideal" tool room internal grinder, just . . .

Send for the Man from Bryant.

Write for new catalog on the No. 112

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Quality Control

(*Continued from page* 21)

of quality which permits one per cent defectives to be accepted. The results of the sampling operation should be recorded on a regular report in a uniform manner, so that they might be reviewed by a trained statistician daily. Use of these tables will reduce inspection costs and assure better quality of parts by putting the inspection where it belongs, on lots containing a high percentage of defective parts.

This program is essentially a single sampling plan. Lots are either accepted or rejected, depending upon the number of defective parts in the sample. Rejected lots are detailed or inspected one hundred per cent, and the results of this detail inspection are recorded also on the report. The per cent defective is also calculated for each "detailed lot." The types of defects found are noted on the back of the report. If these defects are recurrent or serious, steps are taken to eliminate them by modification or improvement in tools or process.

Every day a trained statistician reviews all reports on which postings have been made during the day. This review is made for the purpose of reducing the sample size in the interest of more economical inspection, and the institution of proper control methods at the point where defects are created.

When lots show defects to be unacceptably high, it is necessary that controls be initiated to improve the quality. These controls may be a control chart placed at the operation. Patrol inspection, which is a simplified form of the control chart method, but using only one sample, may be used in some cases. The results of inspection are recorded on a tag, or not recorded at all in some cases. It is very important, however, that whatever method is adopted be adhered to rigorously. If a control chart method is used, it is necessary that tools and/or methods or processes, be changed until the chart shows that the quality has been brought into proper control.

A quick method of determining what might be the assignable cause, is to chart the quality characteristic by means of simple check marks. We refer to this as a frequency distribution. This will quickly show:

(1) Whether the average is wrong. This can be corrected by adjusting the machine or process in order to shift the average in the proper direction and by the proper amount.

(2) Whether the band spread is too wide. This shows too wide variation from part to part. This might be due to dull cutting tools, loose bearings or spindles in the machine, or poor skill on the part of the operator, in the case of bench operations.

If a frequency distribution shows quality to be satisfactory, then a control

(*Turn to page* 78, *please*)

chart can be constructed in the usual manner.

The best type of control chart for this purpose is the conventional X and R chart. This chart shows the center tendency, or average quality, as produced by the process, from time to time, as indicated by the range, R. By adjusting the process or tools to bring about the desired changes in the average, X, and the range, R, it is relatively simple to achieve, and keep, control so the quality will be at the desired level.

It is important that once the plan is inaugurated, it be operated for at least a sufficiently long period to allow time for it to prove itself. Many a good quality control plan has been dropped prematurely because not sufficient time was allowed for the proper training of personnel, or the "correction of bugs." The length of this probationary period will vary from a few days to a few weeks. However, results should become apparent at the end of three or four weeks.

It is well to realize at the outset, that no quality control program will improve quality, increase production, or lower unit costs. The quality control program will point out what defects are created by conditions which need correction. Generally, it cannot recommend or suggest the necessary corrections. These have to be made by the line organization; therefore, it is well to realize that defects are created by the process and that the process must be corrected by the line organization. The inspector, in his administration of the quality control program, merely assists the line organization in the detection of that part of the process which is out of control. Without the whole-hearted cooperation of the line organization, no quality control program can be expected to succeed, for it must be realized at all times, that "Quality must be built into a product —it cannot be inspected into it."

New Corporation to Make Chlorinated Solvents

The Hooker-Detrex Corp. has been incorporated under the laws of the State of New York with a capitalization of 6000 shares of preferred stock and 1500 shares of common stock. This is a corporation jointly owned by Hooker Electrochemical Co. whose main office is located at Niagara Falls, N. Y., and Detrex Corp. whose main office is located in Detroit, Mich.

The corporation has been formed for the purpose of manufacturing chlorinated solvents, the distribution and sales of which will be handled by the Detrex Corp.

Altitude Test Stand for Turbo Jet Engines

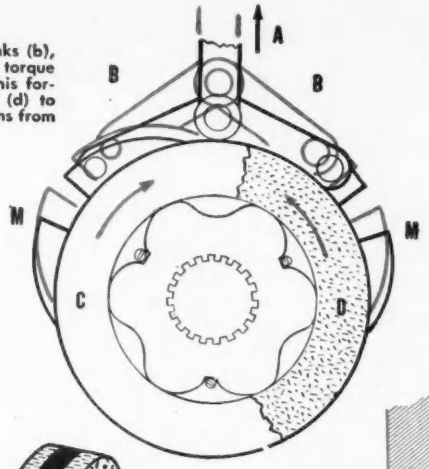
The BMW plant near Munich, Germany, was bombed extensively during the war, but the special altitude test stand for aircraft engines located at Oberweisenfeld on the northern boundary of the plant sustained very little damage. The test cell has a diameter of 12 ft and can be operated at a pressure equivalent to 50,000 ft altitude. Intake air can be supplied to the units at speeds up to 550 mph and at temperatures down to —65 F. The British de Havilland Co. has used this facility to run a complete set of altitude calibration tests on their Goblin turbo jet.

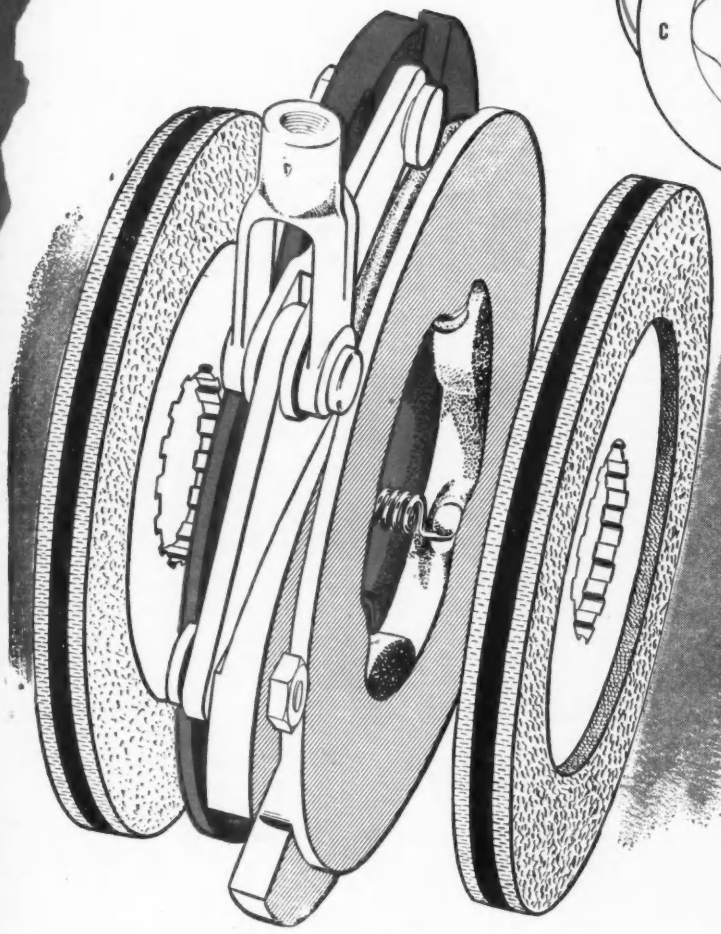
Zerone-Zerex District Offices Transferred

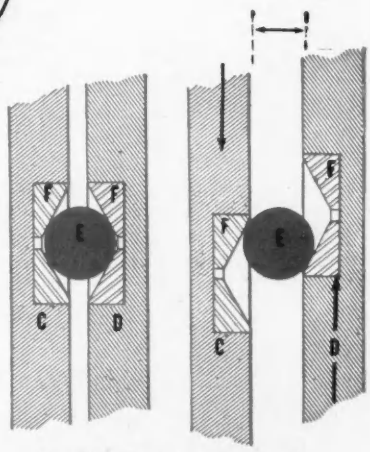
The four "Zerone"-"Zerex" antifreeze district sales offices were transferred from Wilmington, Del., to new headquarters in New York, St. Louis, Chicago and Denver, according to an announcement by E. I. du Pont de Nemours and Co.

The transfer was completed during June, the home office remaining in Wilmington. F. C. Noble is sales manager of the "Zerone"-"Zerex" section of the du Pont Ammonia Department and H. L. Corkran is assistant sales manager.

1. Force applied to yoke (a) pulls links (b), each of which is fastened to the torque lug (m) of the actuating discs. This forward movement causes discs (c) (d) to begin rotating in opposite directions from each other.

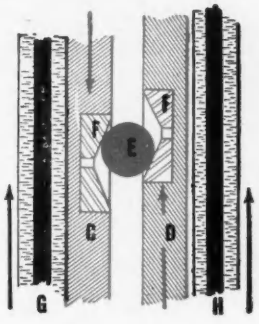


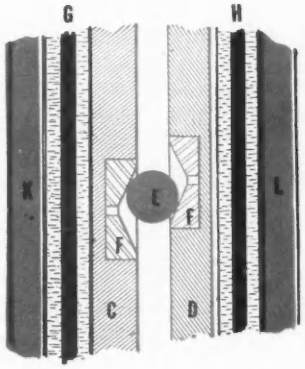




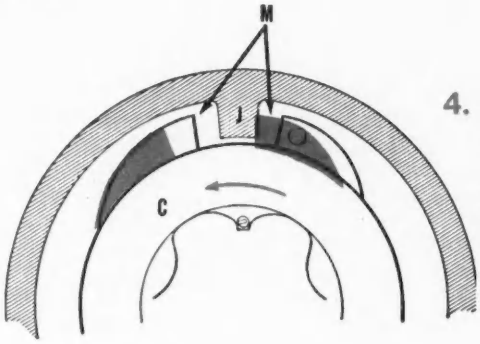
2. This opposite rotational movement forces balls (e) to roll up the incline of the inserts (f), thus forcing the two actuating discs (c) (d) to separate further.

3. As the discs (c) (d) separate, they engage the rotating discs (g) (h) which are faced on both sides with brake linings. This engagement causes the discs to further actuate the energizing elements; see preceding illustration (e) and (f). Thus, the actuating discs are further forced against the brake lining on the rotating discs (g) (h).





5. As movement continues the braking action is completed by the absorption of the torque through the stationary plates (k) (l).



4. This forward movement of the actuating disc, caused by the frictional engagement against the rotating surface, causes one of the two discs to move forward to a point where the torque lug (m) in the disc abuts the projecting lug (j) in the housing. When this occurs, the actuating disc so engaged becomes the stationary or power plate. When the direction of the rotating frictional discs are reversed, the identical action occurs on the opposite actuating disc.

for *automotive vehicles and industrial machinery*

Lambert Disc Brakes

Air • Hydraulic • Mechanical

Products of a Division of the Auto Specialties Mfg. Co.

St. Joseph, Michigan • Windsor, Ont., Canada

1682

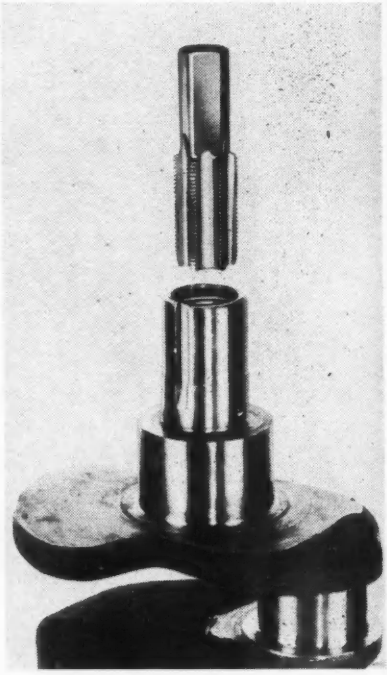
New Production Equipment

(*Continued from page* 42)

tension flywheel magneto. Horsepower developed is 7.7 at 3200 rpm. A simple friction type clutch provides one speed forward, one speed reverse, and neutral. Drive is by means of a heavy duty roller chain to the rear axle. An internal expanding brake on the intermediate shaft is applied by a standard brake pedal, and automatically applied whenever the operator leaves the seat. The wheel base of the unit is 78¾ in. with overall length of chassis 113¾ in. Tread is 35 in. Sixteen inch pneumatic tires, six-ply heavy duty with inner tubes are used, with dual tires in the rear and a single tire at the front. The unit is steered by a handle or tiller.

CRANKSHAFT threading is said to have been stepped up at a large automobile manufacturer's engine plant through the use of special ground taps, designed and produced by Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich. The special steel crankshaft forgings when heat treated for high strength tend to develop a crystalline structure that resists cutting.

The crankshaft requires a 1⅛ in.-14 NS thread tapped in the front end,

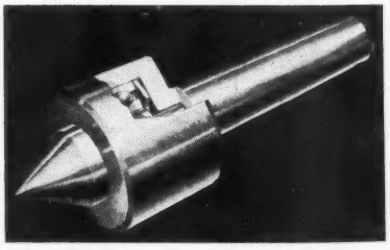


Specially-designed Detroit tap for crankshaft threading

concentric with the main journals. The threaded section is ⅞ in. deep between an outer counterbore and a bottom recess. Both concentricity and pitch diameter have to be held to close limits.

The specially designed ground tap distributes the cutting load over a 3½-thread chamfer on each of six straight flutes. Eccentric relief of the chamfered section is minimized to provide maximum support of the cutting edges and maintain full concentricity of the thread.

THE RAYMOND CORP., 412-A Republic Bldg., Cleveland 15, Ohio, has placed on the market the Coles live center in which a thrust compensator is provided



Cut-away view of Coles live center

which allows the rotating point to move backwards when the thrust multiplies and danger of overloading becomes a factor.

A full-length rotating center point is provided to minimize chatter and sway

(*Turn to page* 85, *please*)

at point of contact. This rotating center extends deep into the shank of the housing, thus allowing more material to absorb chatter and using the farthest possible bearing point to eliminate side sway. The alloy steel rotating center point is hardened to 62-65 Rockwell for greater wear resistance.

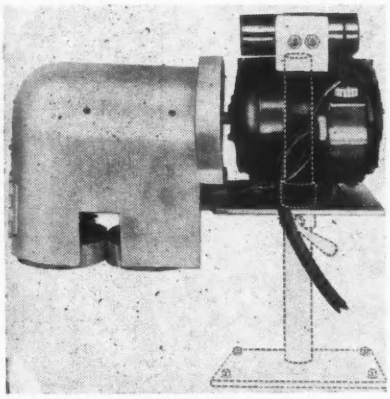
These centers are provided with a matched set of duplex ball bearings in the heads. The bearings take the full radial load with minimum friction and wear. Since these double row bearings are assembled in a tandem position, the maximum thrust and radial capacity are obtained.

To answer the demand for a double-drive rotary heat sealer for bags, pouches, etc., Pack-Rite Machines, 714 West Wisconsin Ave., Milwaukee, Wis., offers its new "Fast-Tite" model.

Thermostatically controlled to seal a wide range of heat sealing materials, the "Fast-Tite" can be operated horizontally, vertically or at an angle and can seal any length bag, pouch, barrier, etc.

"Double-drive"—the driving of both sealing roller shafts, thus eliminating pulling or distortion of the bags as they travel through the sealing rollers—is one of the principal features.

Speed is another feature—up to 300



Pack-Rite rotary sealer

or more lineal in. per minute, depending on material being sealed. Wiring is directly to stationary ring heating units under transite plates covering both sealing rollers. A tension adjustment is provided for pressure on sealing rollers. Choice of sealing krimps; vertical, horizontal, checkered—or flat seal.

A preheater attachment is available for materials which require preheating before entering sealing rollers.

Victory Engineering & Machine Works, Inc., 3000 Chouteau, St. Louis 3, Mo., has brought out a line of automatic fixtures for continuous seam welding of tubes and tanks. The welding head in the new method remains stationary and the work moves

(*Turn to page 86, please*)

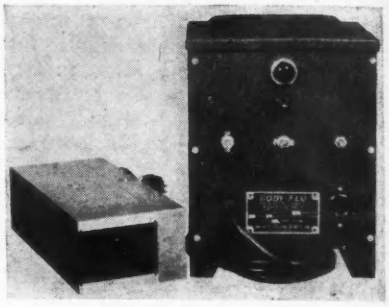
under the head in a continuous moving stream.

The Victory automatic seam welder has a variable speed range of from 60 to 150 in. per minute of weld. The drive includes reversing and inching controls. Speed can be altered while the work is in motion.

Model 0412 has a continuous micrometer size adjustment from four to 12 in. in diameter. Models 1224 and 2436 have adjustments from 12 to 24 in. and 24 to 36 in. respectively. Where production is limited to only one diameter, then Special models are designed. The above models have adjustments for wall thickness from 18 ga to 3/16 in.

MAGNETIC HOLDING DEVICES, INC., 2034 E. 22nd St., Cleveland 15, Ohio, is making a heavy-duty magnetic chuck and parallel for use in tool rooms, on surface grinders, and for production. Named the "Body Flo," it is said to offer a simple solution to clamping problems when using climb or down milling with non-magnetic carbide-tipped cutters.

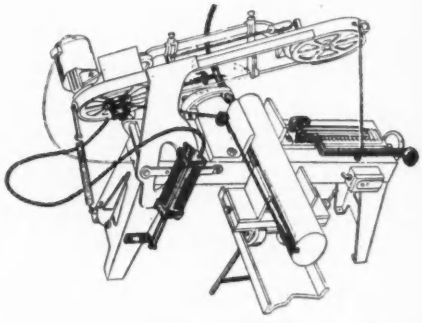
Power for the Body Flo magnetic chuck is supplied by a unit which incorporates a power selector for stepping up the electric current thereby increasing the magnetic holding power and a new magnetizing and demagnetizing switch with correct timing for the demagnetizing operation and with automatic return to the "off" position.



Body Flo magnetic chuck and power supply unit

The Body Flo chuck utilizes low-voltage direct current. A remote magnetizing and demagnetizing extension switch may be mounted on the machine tool adjacent to the operating controls.

SAW-MATIC, an attachment that converts manually operated metal cut-off saws to full automatic operation, has been built by Machine Specialties, 4029 No. Kedzie Ave., Chicago 18, Ill. Sold as a complete package unit, Saw-Matic consists of: (1) Pull-up device, (2) Vise clamp mechanism, (3) Saw lifting and lowering device, (4) Sensitive length control valve of special design.



Saw equipped with Saw-Matic attachment

The unit will cut any length from 3/16 in. up, automatically, and will saw all day without an attendant. Consistency in length of cut is achieved by a special friction pull-up device and an especially sensitive valve, so that the last piece sawed is said to be the same length as the first on production runs. A special Saw-Matic unit is being built to fit each make of the more widely used metal cut-off saws.

A change from automatic to manual saw operation can be made by turning the hand valve on the air line. The automatic attachment will operate from as little as 60 lb compressed air.

SUITED to laboratory and general service, a self-contained platen press that can be operated at pressures from 1000 psi up to 3000 psi by setting the automatic pressure controller at the required pressure is a recent development of R. D. Wood Co., Public Ledger Bldg.,

(*Turn to page* 88, *please*)

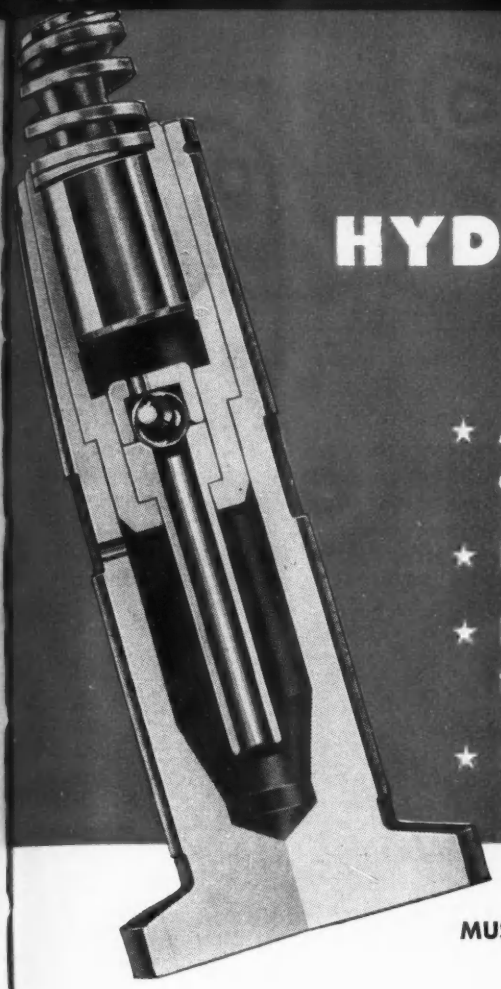
Zero-Lash

Registered U. S. Patent Office

HYDRAULIC VALVE LIFTERS

provide

- ★ Accurate valve timing and perfect seating at all engine speeds and temperatures.
- ★ Longer life for valves and seats.
- ★ Freedom from adjustment for the life of the engine.
- ★ Silent valve train operation.

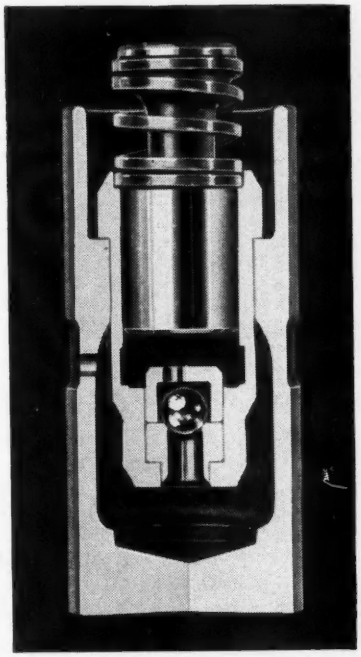


MUSHROOM TYPE

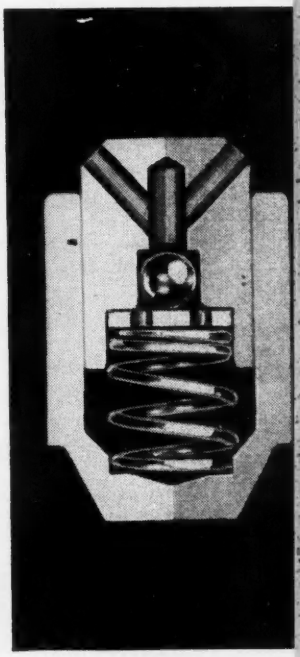
The *Zero-Lash* Hydraulic Valve Lifter is a simple, positive-action device, which automatically adjusts its own length during each revolution of the camshaft to compensate for expansion or contraction in the valve train. It is available in three basic types—mushroom, barrel, and stub—which are adaptable to all internal combustion engines, gasoline or Diesel.

In addition to improved engine performance, longer service life for valve train parts, and silent operation, *Zero-Lash* Hydraulic Valve Lifters eliminate the need for adjustment, and permit the simplest and most advantageous engine design.

Eaton engineers will be glad to discuss the application of *Zero-Lash* Hydraulic Valve Lifters to engines now in design.



BARREL TYPE



STUB TYPE

Illustrated literature covering the design and operation of Zero-Lash Hydraulic Valve Lifters, including reports of outstanding service records, will be furnished upon request.

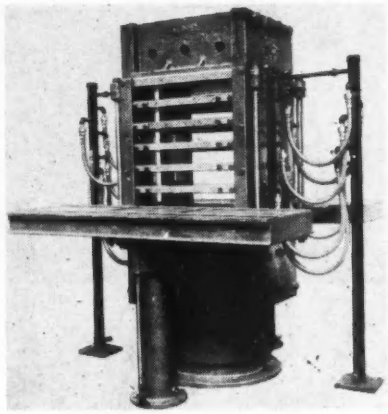
EATON

MANUFACTURING COMPANY
WILCOX-RICH DIVISION
9771 French Road • Detroit 13, Michigan

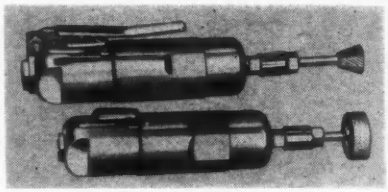
Philadelphia 5, Pa. Press is closed by push button control.

In operation, when predetermined pressure has been reached, the pump is automatically stopped. During curing period, in the event that pressure in the system should drop 2 per cent to 2¼ per cent, the pump is automatically started to rebuild the required pressure. At the end of the curing period, pressure is released from cylinder and press opens by operating the release valve.

The 15-in. by 15-in. by 2-in. platens, whether steam—as illustrated—or electrically heated, are machined parallel



Wood platen press



Ideal rotary file and grinder

within .003 in. and provided with smooth tool finish. The intermediate heating platen is suspended by steel hanger rods and guided on the columns by means of cast iron guide brackets.

Pressure is supplied by a 3.8 gpm, 3000 psi capacity radial piston pump, driven by a 5 hp, 1200 rpm motor.

LATEST addition to the line of Ideal Industries Inc. 3000 Park Ave., Sycamore, Ill., is a small, lightweight pneumatic file and die grinder. It is 6½ in. long by 1½ in. diameter and weighs 1 lb. It is rated at ¼ hp at 19,000 rpm with air at 90 psi. Maximum speed is 25,000 rpm.

The standard chuck, as furnished, is made for tools having ¼ in. shanks or a flexible sleeve may be obtained for ⅛ in. or 3/16 in. shanks. The motor is available with either lever or button type of control.